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# Science on a kite string

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QUAECUMQUE VERA

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2735604

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2735604

The Vancouver Environment Education Project is a cooperative project between the schools of B.C. and The Western Education Development Group in the Faculty of Education at the University of British Columbia. The materials are developed by teachers using the facilities of the Vancouver Environment Education Center. The project is directed by Dr. Kip Anastasiou. V.E.E.P. is prepared to provide substitutes for teachers who need time to research and formalize ideas for curriculum suited to Canadian schools.

V.E.E.P. has been supported by The B.C. Forest Service, Cominco, the B.C. Department of Education, B.C. Hydro, the McLean Foundation, the Manpower and Immigration Local Initiatives Program, the Leon and Thea Koerner Foundation, and the Justice Development Commission. It operates with the cooperation of the B.C. Teachers' Federation and various school boards.

V.E.E.P. is dedicated to the development of educational materials related to the Canadian environment. It is a broadly based interdisciplinary project. Although most of the materials are designed to provide elementary school teachers and children avenues of exploration on a continuing basis in the environments which make up their real world, an active programme of curriculum development for secondary schools is under way.

Co-operating Schools: Queen Elizabeth Annex, Cook School Annex, Norquay, University Hill, Bayview, Selkirk, McCorkindale, General Gordon, Southlands, Carnarvon, Begbie, Oppenheimer and Henderson Annex of Vancouver; St. Judes of the Catholic Schools; Cypress Park of West Vancouver; Thrift Elementary, Matthew Elementary, Dr. Sinclair Elementary and Newton Jr. Secondary in Surrey; Argyle Secondary in North Vancouver; McNair High School and Hugh McRoberts Jr. Secondary of Richmond; Eagle River Elementary-Secondary School of Sicamous; Comox Jr. Secondary School, Courtenay District; Nanaimo Sr. Secondary School, Nanaimo District; Mountain View Elementary School, Como Lake Jr. Secondary School, Mary Hill Jr. Secondary School, George Pearkes Jr. Secondary School, Montgomery Jr. Secondary School, Sir Frederic Banting Jr. Secondary School, Moody Jr. Secondary School, Winslow Jr. Secondary School and Sunny Park School of Coquitlam.

Curriculum Associates: Wendy Stockstad, Hilary Strath, Tom Purakal, Joan Fefferman, James Gibb, Susan Infanti, Julia Kamm, Ron Miller, Arlene Offer, Victoria Tercias, Cathy Henry, Pat Woolsey, Mike Hoebel, Eve Alexander, Anne Nesbitt, Wendy Twining, Cindy Barrett, Kathy Brunner, Martin Conder, Melissa Hadley, Heather Harris, Liz Bowen, Duncan Ascough, Paul Bailey, Leslie Baker, Ken Borkowski, Gordon Calderwood, Frank Heyman, Helen Smith, Bob Sigstad, David Williams, Ed Korbin, Jim Stevens, Eric Tsang, Doris Potts, Dennis Flesher, Deryck Holdsworth, Doug Ante, Louise Ritchie, Mollie Byrne, Neil Dyck, Dot Palmarche, Jim McLaren, Sue Gibbs, Mark Gibbs, Rob Inrig, John Hoover, Peter Beckett, Ingrid Carley, Reiner Specht, Peter Napper, Elaine Mascali.

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I would also like to acknowledge some of the many children who worked so hard and enthusiastically on their kites. Watching them "learn" has taught me a great deal. Thank you to Cindy Logan for her truly amazing "Flying Turkey Platter", I never said it wouldn't fly, I kept that to myself, but I was wrong, it did. Thank you Steven Ross, Laurie Fyfe, Chris Wiebe, Terry Seymour, Jocelyn Barker, Bob Georgiadi and all the other children of Oppenheimer School. And thank you Division 2 of John Henderson Annex for your cooperation. Without it the revision would have been much harder to do.

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Courtesy The Vancouver Sun

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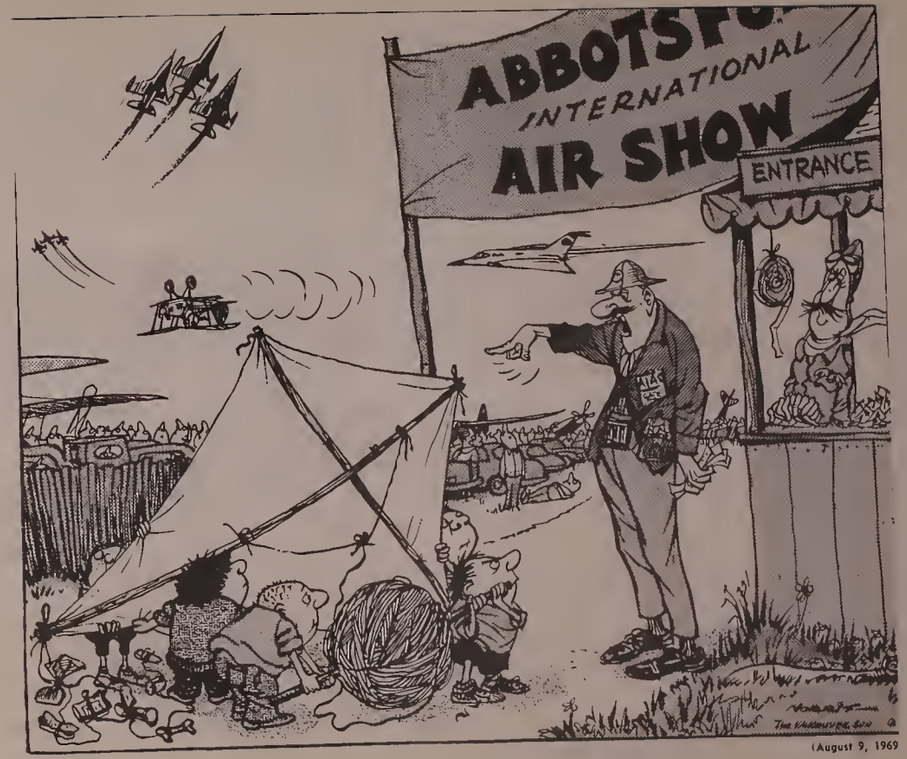


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Courtesy The Vancouver Sun

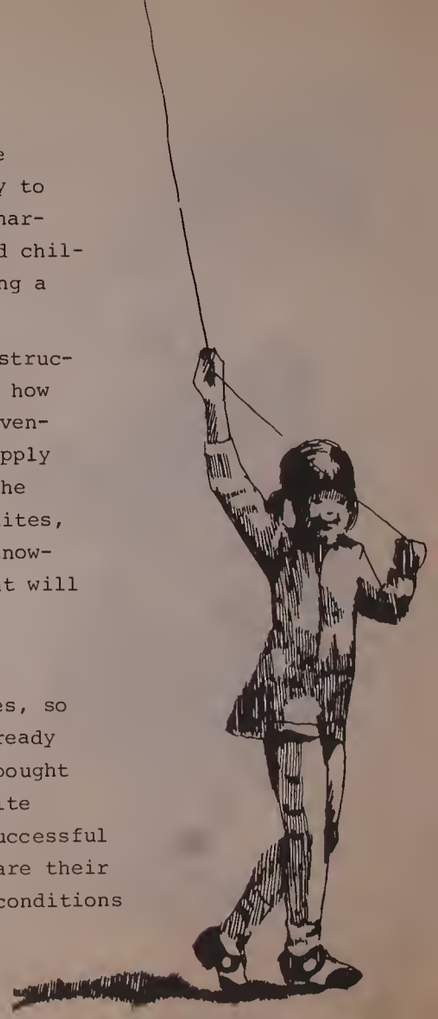
## Introduction

Kite flying is a challenge everyone enjoys. The excitement of sending a kite into the bright blue sky to dip and soar at your command, (or at its whim), and harnessing that unseen wind is a joy for both adults and children. Even more satisfying is the thrill of launching a kite of your own making it dance in the wind.

Making a kite is not only enjoyable but also instructive. A successful kite demands an understanding of how a kite flies. It involves precision and balance, inventiveness and patience. This unit will attempt to supply the guidelines for successful kite construction in the classroom. By making and even designing their own kites, children will have the opportunity of testing this knowledge against the wind. And both teacher and student will enjoy the challenge.

## Getting Started

Many of your pupils may have already flown kites, so it may be a good idea to discuss what your class already knows about kiting. What types of kites have they bought or made? Discuss their successes and failures in kite flying. How important do they think design is in successful kiting? How about wind conditions? You might compare their suggestions and ideas with the kite types and wind conditions in the appendix.



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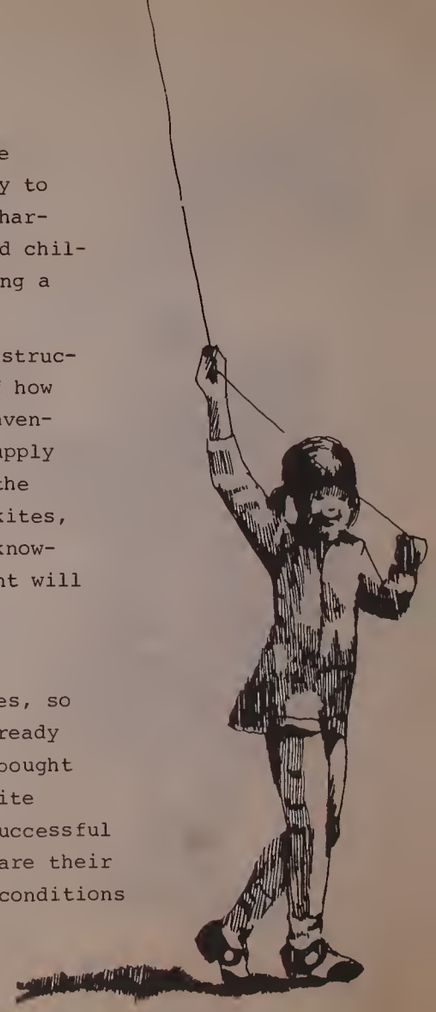


Once you have stressed the importance of design to the class, they can begin to design and make their own kites. Challenge those pupils who have successfully flown kites to try a new design, and encourage them to help those who have not flown kites before.

Instructions for basic designs are found later in this unit. These designs are easy to make, but, like all successful kites, demand precision and accuracy. Children will enjoy decorating their own kites in unique and striking ways, whether or not the kite is of their own design. Encouragement should be given to those who wish to choose their own designs, for not only will this produce a pleasing array of designs, it will also lead to problem solving in the aerodynamics of kites.

Wall displays, articles on kites, newspaper clippings, and cartoons can be used to stimulate thinking about kites.

Designs and Designs

In what subject should you teach kiting? Mathematics? Social Studies? Art? Science? Language Arts? or?

Mathematics:

When Alexander Graham Bell finished with the telephone he turned his energy to kites in the hope that he would discover a practical heavier-than-air flying machine. In his attempt to develop a practical airplane Bell experimented with every conceivable geometric shape that would



fly. He finally settled for the tetrahedron, built a kite of several thousand cells and flew it with a pilot. The Wright Brothers won the race into the air by using a varient of Hargrave's Box Kite. They were successful because the Box Kite satisfied their calculations through extensive wind tunnel testing. What better experience with measurement and geometry could you give children than making a real object. Try circular, triangular, polygonal, tetrahedral and prismatic shapes. Bell chose the tetrahedron, the Wright's the rectangle, what would your students settle for?

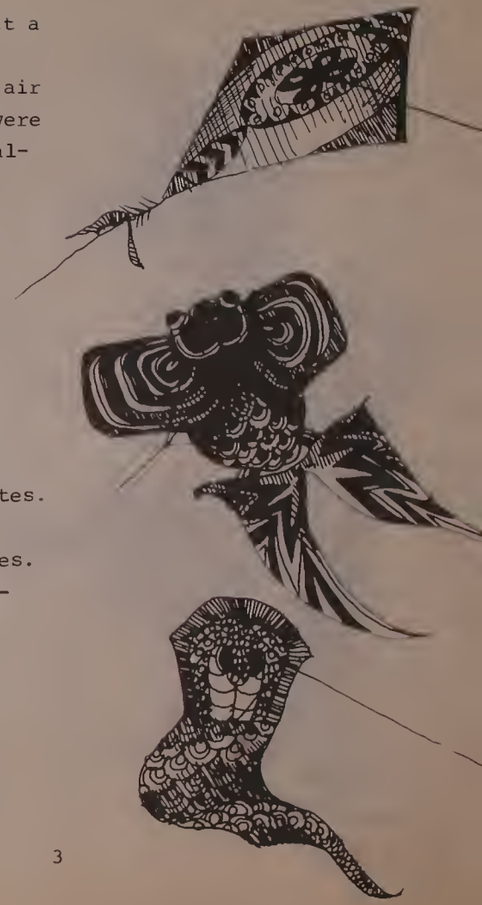
Social Studies:

Give your class a study of the history of kites. There are real people with very real problems who used kites to find a solution to their difficulties. End your study with a flying contest based on historic problems.

Questions for Research:

Who was the first person to go fly a kite? Which country is given credit for the invention of the kite? The Greeks, Indians, and Egyptians all claim first but does the evidence prove the Chinese claim?





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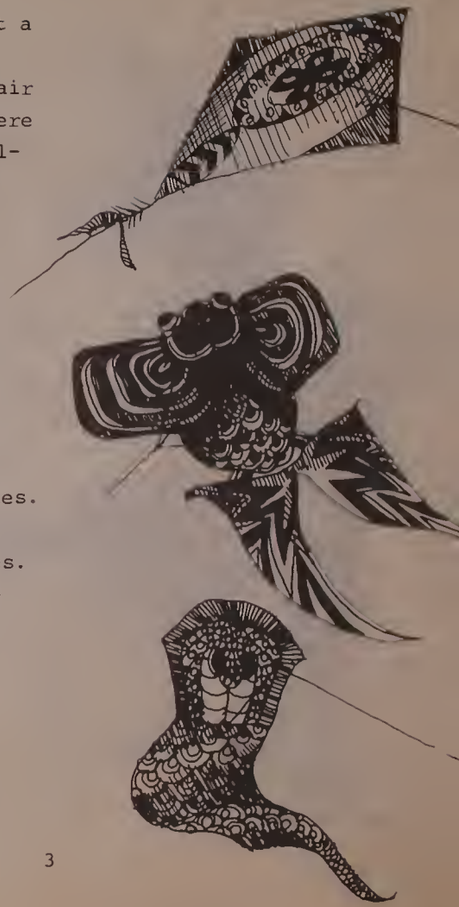
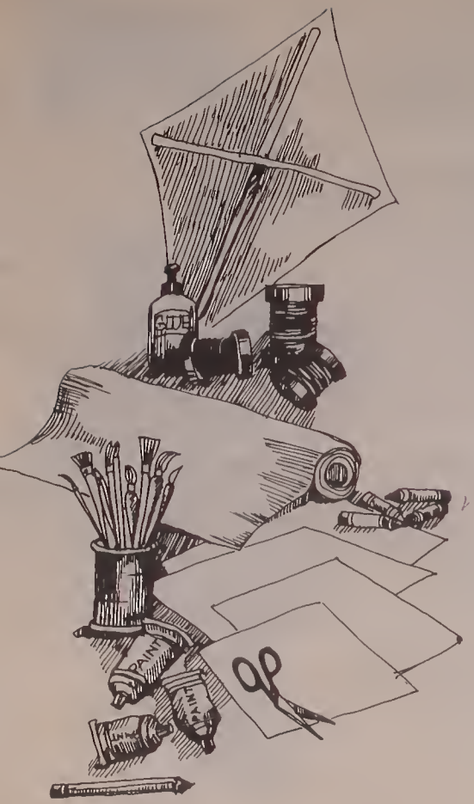





Almost every country can claim a distinctive kite type either invented or adopted. Japan, the rectangular kite; China, birds, insects and fish; Malaysia, the square or diamond; India, the fighter kite; Australia, the box kite; France, the Coyne Military kite; England, the round bow; Mexico, the Chiringa. The U.S.A. has several of them: the tetrahedron, the parafoil, the Eddy Bow. Study the men who were involved in kite flying and their motives and you will find philosophers, generals, artists, kings, doctors, physicists, engineers of all professions, inventors, spys, hobbyists and even robbers. These men and their stories will be fascinating not only to you but to your pupils as well.

Art:

The range of activities here for the art teacher is limited only by the storage ability of the room and how far the teacher and class are willing to pursue this unit. Think of the colours, textures, materials, paints, papers, designs, patterns that can be married, blended, and manipulated into an object which will fly. After seeing so many hours of classwork thrown away at the end of an art unit, children will appreciate making something which allows for creativity but also can be used. Who can produce the most original design?



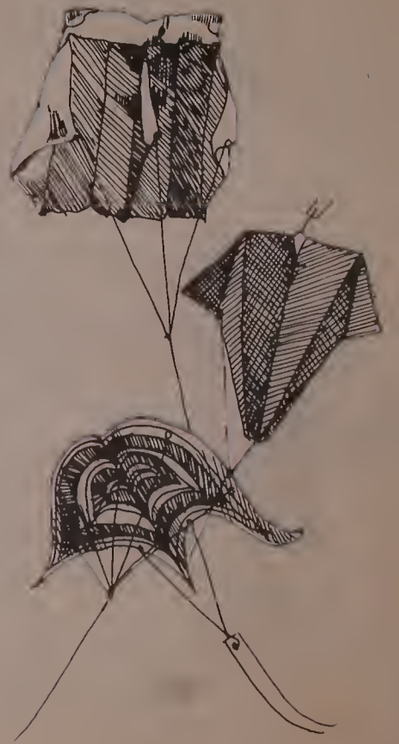
Original pattern? Creative shape? Does it have to fly?

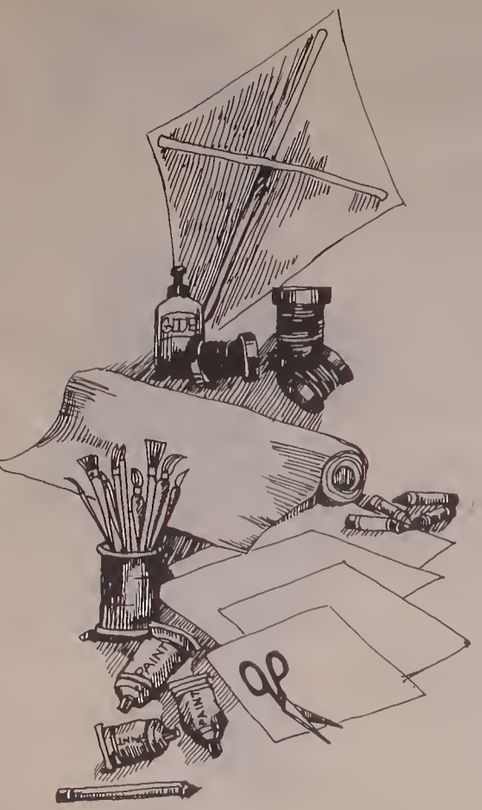
Science:

The range of activities for science could cover all the kite ideas above and more. Kites can be used as a means of studying wind conditions, cloud cover and air turbulence.

What makes a kite go up? Drag, lift, wind, weight of kite, angle to the ground and thrust -- All these ideas are important for an understanding of flight.

Compare kite shapes to the shapes of nature's crystals: table salt, Epsom salt, and so on. How does the shape of kites compare to man's architecture? What is the lifting power of a kite? Is there a ratio of weight to surface area for lift? The questions are the same ones others have already worked on and answered, but that does not mean that kiting is a closed field. Domina Jalbert innovated and produced a design called the parafoil sled. Dr. Francis M. Rogallo discovered the parawing. The paper chiringa is the patented design of Rex Zachery of California. The field of kiting is far from closed and new



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designs will be met with enthusiasm by kiters the world over.

Language Arts:

The vocabulary of kiting is a rich area for study. The possibilities for spelling, phonics, short reports, stories, picture stories are great.

| | | |
|---|---|---|
| kite | spar | hexagon |
| angle | bridle | diamond |
| lift | barrage | tetrahedron |
| precision | longeron(keel) | delta |
| balance | cell | foil |
| force | bow | flat |

Use the child's thrill of a successful flight to encourage poetry, tales of fantasy, recording observations. A large class book of compiled stories about kites from other lands might be interesting. You can develop a story of a convention of kites, a gathering in your school of the national representative kite types. Senor Chiringa of Mexico, Monsieur Coyne of France, Mr. Round Bow of England and so on. In many instances preferred kites shapes are determined by culture. Use this different historical and cultural material gleaned from the children's research for creative writing.

Try some of these suggestions:



(1) Photography from kites. What could be more fascinating than some aerial photography from directly over the school grounds - kite flyers included. A simple box camera, a spring and a firecracker punk as a release mechanism will help you get started.

(2) Who can make the largest kite that will fly? A study in strength, equipment, material and co-operative abilities of a group to reach a successful conclusion.

(3) An individual assignment to see who can make the smallest flyable kite. Which materials are most suited to this challenge -- toothpicks and saran wrap or drinking straws and tissue paper? What else?

(4) Kite climbers - what devices and release mechanisms can you design for carrying parachutes, confetti, streamers up to the kite for release?

(5) Altitude contests and kite trains - you don't have to go quite as high as the group mentioned in the newspaper clipping. Limit your pupils to 50' 100' and 150' of line and ask who can achieve maximum altitude first and maintain that height the longest.

(6) By stringing kites together children can have the excitement of seeing their kites fly through, over and into the clouds. Perhaps a way could be devised to trap or catch a bit of the cloud in a bottle or on a blotter?

ld.
"Everybody
pretty upset abou
around," he said. "I've
a lot fo comments about
dirt down here, especially

**World kite record**

GARY, Ind. — On June 13, 1969, Gary high-school students sent aloft a train of 19 kites — paying out more than 10 miles of line — which in seven hours soared to 35,531 feet, believed a world record for kites.

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(2) Who can make the largest kite that will fly? A study in strength, equipment, material and co-operative abilities of a group to reach a successful conclusion.

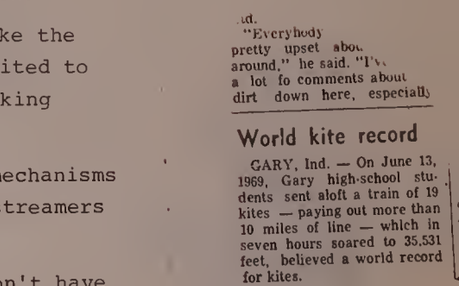
(3) An individual assignment to see who can make the smallest flyable kite. Which materials are most suited to this challenge -- toothpicks and saran wrap or drinking straws and tissue paper? What else?

(4) Kite climbers - what devices and release mechanisms can you design for carrying parachutes, confetti, streamers up to the kite for release?

(5) Altitude contests and kite trains - you don't have to go quite as high as the group mentioned in the newspaper clipping. Limit your pupils to 50' 100' and 150' of line and ask who can achieve maximum altitude first and maintain that height the longest.

(6) By stringing kites together children can have the excitement of seeing their kites fly through, over and into the clouds. Perhaps a way could be devised to trap or catch a bit of the cloud in a bottle or on a blotter?

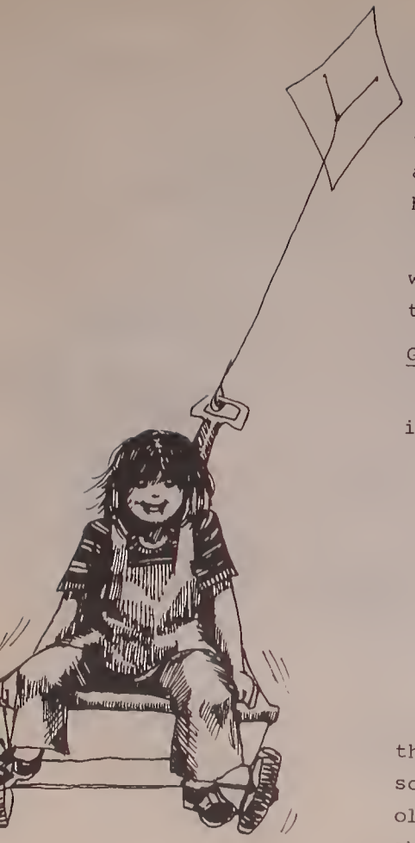




id.
"Everybody
pretty upset abou
around," he said. "I've
a lot fo comments about
dirt down here, especially

**World kite record**

GARY, Ind. — On June 13, 1969, Gary high-school students sent aloft a train of 19 kites — paying out more than 10 miles of line — which in seven hours soared to 35,531 feet, believed a world record for kites.



(7) You might want to repeat George Pocock's experiment. Have someone bring a wagon, any size will do and have a kite tow a pupil across the playground. Besides giving a dramatic demonstration of the pull of a kite children may develop an appreciation of why a kite string can burn or cut your hand.

Discuss kites with your class and decide the course you want to pursue, then use the enthusiasm and excitement of total involvement to achieve your goals.

Gathering Materials

Some basic materials are essential for building kites in the classroom. Have a good supply of:

- straight wood
- bamboo reeds
- twine
- linen thread
- white glue (bondfast)
- clothespins
- plastic tape
- covering materials
- pencils
- ruler
- split rings
- compass
- pliers
- knife
- scissors
- flying line

Materials for finer finishing can be added later as they are thought of. Much of the material needed can be scrounged by the children. Just ask them for straight wood, old bamboo rods and bamboo window curtains and you will be able to pick and choose the best.

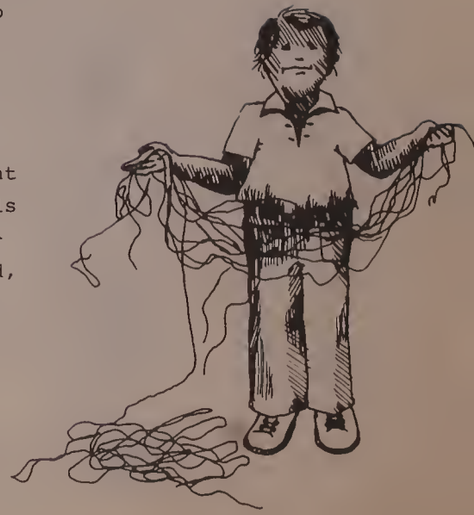


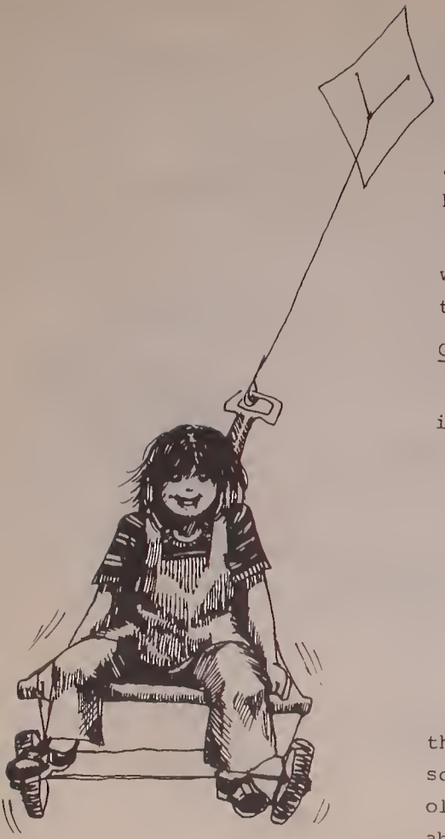
Have the children bring in their old kites for displays. Ideas from these will be extremely valuable during construction. The children will be able to see how the commercial manufacturers mass produce and cut corners. If the kites are broken so much the better. It will show the children where reinforcing is necessary.

There is a wide range of choice for flying lines. The flying line must, of course be chosen in terms of the kite size and weight. However, try to avoid loosely twisted threads and string as they tend to knot when slack. Braided line is hard to find in long lengths and is expensive, but it will give tremendous strength for the weight of line. Probably the best choice would be nylon monofilament fishing line. It comes in many strengths, in spools of almost any length you could want and is inexpensive. Most lines and threads are sold by the pound, 1/2 pound and 1/4 pound spools. Several excellent sources of supply are listed in the appendix.

Building the Kites

When you begin to build the kites, it is usually more convenient to move the desks to the sides of the classroom and work on the floor. You can arrange a centrally located pool of





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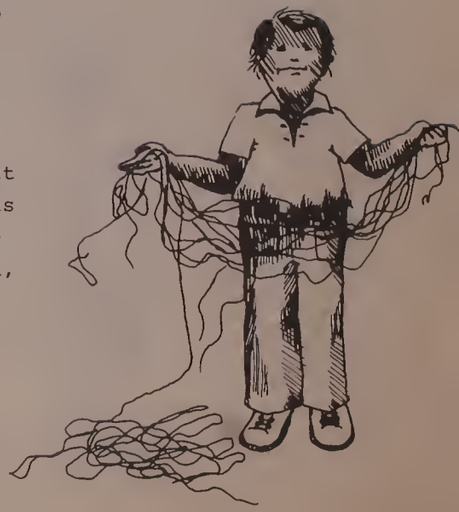

materials from which the children can obtain what they need and return what they don't use. The kites can be hung from wires or string lines across the room, the tackboard, or roof supports if you have them. Encourage the children to use long pieces of wood, bamboo and string in their first attempts at construction. It is easier to trim off excess materials than to untie and unglue a piece which is too short.

One of the most important considerations in kite construction is accuracy. Precise measurement and balance are essential for a successful kite. Have the children check and recheck the balance of their frames as construction progresses. This can be done very simply, place one end of the keel on a table and put the other end on your finger, if the kite is not balanced the spar will rotate to the heavy side. If it is not practical to trim the heavy side, weight the light side with plasticine until a good approximation is reached.

Check the balance of all flat and bow kite frames before covering. A tail will correct minor problems but not major ones. For the kite flying purist success with tailless kites

is the crowning achievement of his art.

When applying the cover material to flat kites it should be tight with no pocketing of the flying surface. Make sure all the frame is glued to the covering. Flat kites depend on the marriage of paper and frame for strength. This will give a very strong and resilient kite for size and weight.

Strings and knots should be given care and attention. Strings should be taut particularly in the outside framing of kites that require this. Knots should be tight and not slip when pulled. Tie a third loop to make sure no slipping occurs and add a dab of Bondfast white glue to ensure that they stay put. Any extra care and consideration here will pay dividends when the unexpected occurs while flying.

When a kite is flying, all the strain is channelled down the flying line and all the joints are therefore under considerable pressure. Hence the need for strength in construction should be emphasized. Even a flat kite will bend or develop a curve during the stress of flying and if anything will pull loose or break this is when it will happen.

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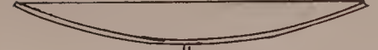
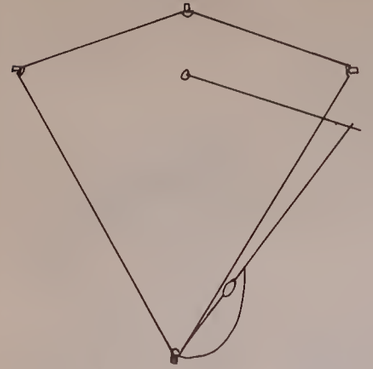
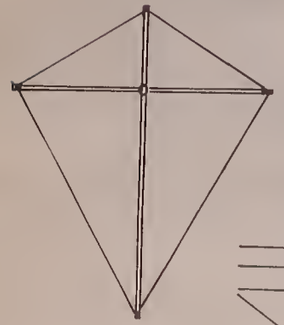
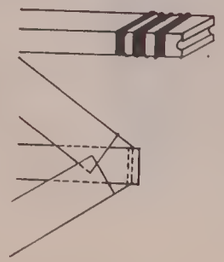








## The Basic Bow Kites

The basic bow kite will serve to illustrate nearly all the techniques needed to build and cover kites designed with a framework. The bow kite also has a high frequency of success in flying, which is of prime importance when children, whose patience is limited, are building kites.

Construction begins with a keel for a centre mast and a crossmember on spar making a crossed frame. Notch both ends of the keel and spar. These notches will guide your string or thread for the outside shape of the kite. The notched ends should be tied or bound with tape to prevent them from splitting when the kite flies. Do not cut too deeply into the crossmember when notching or it may split immediately. The spar should be equal to the length of the keel and tied at right angles 4/5 the way along the keel. The correct proportions are essential to the kite's success.

Balance should be checked at this stage. To check the balance, place the tip of the keel on a table and place the other end on your finger. If the spar is not exactly centred, the keel will rotate to the heavier side. Adjust the spar until the frame is balanced, then firmly tie the keel and spar together and dab glue on the knots. On larger kites with heavier wood the spar



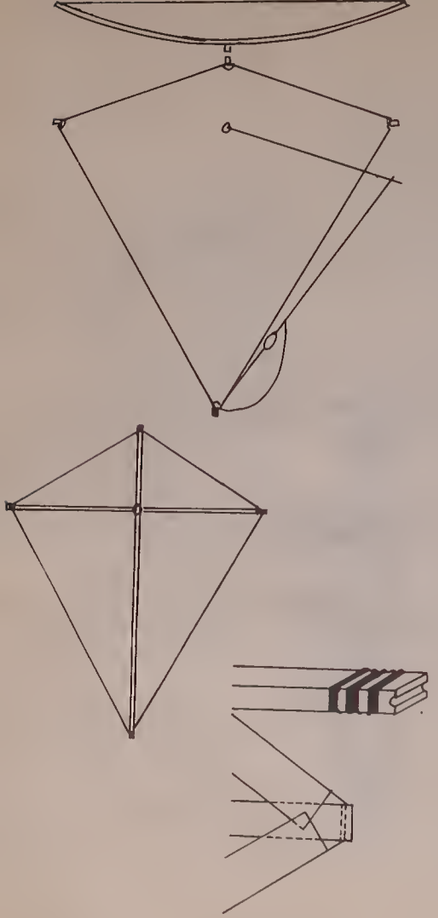
and keel can be drilled and the pieces held together with a wing nut, bolt and two washers. This permits easy storage when the flying is finished and the kite can be dissembled. When the glue is dry, string thread around the outside of the frame through the notches and tie the thread firmly to each tip of the frame. This will prevent the perimeter thread from pulling loose when the kite is flying.

## Covering Materials

Coverings on the kite can be almost any material the builder wishes. You should, however, take into account weight and size. The bigger the kite, the heavier the covering material should be, otherwise it will tear. Paper is very handy in that it can be cut and glued or taped very easily. Cloth, on the other hand, has to be stitched and is expensive. Plastic is perhaps one of the better materials to work with in building kites in the classroom. It comes in many different weights and colours and is an excellent all-round covering for nearly all kite designs.

Note:

This kite is very adaptable to changes in size. It can be made from toothpicks and saran wrap or from 14 foot bamboo poles and poly bags or poly sheeting. Size is not important. Precision in measurements and balance is. Don't be afraid to use relatively large pieces of wood in the



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construction of your kites. For example commercial kite builders use very thin strips of wood for framing. 1/4" by 1/8" for bow kites or the smallest possible dowling available on bat kites. Their frames do not stand up to rough handling, strong winds or hard landings; therefore increase the size of wood by double that thickness or better. This will give pupils the best possible chance for success, particularly if this is their first venture into building and flying kites. You are looking for strength, the surface area will provide the lift you want.

Plastic garbage bags, construction plastic and laundry bags will give the children a large selection of colours and strengths for coverings. Plastic electrician's tape is excellent for fastening the covering to the frame. There is also a good range of colours in this type of tape and it can be used for designs on the kites as well.

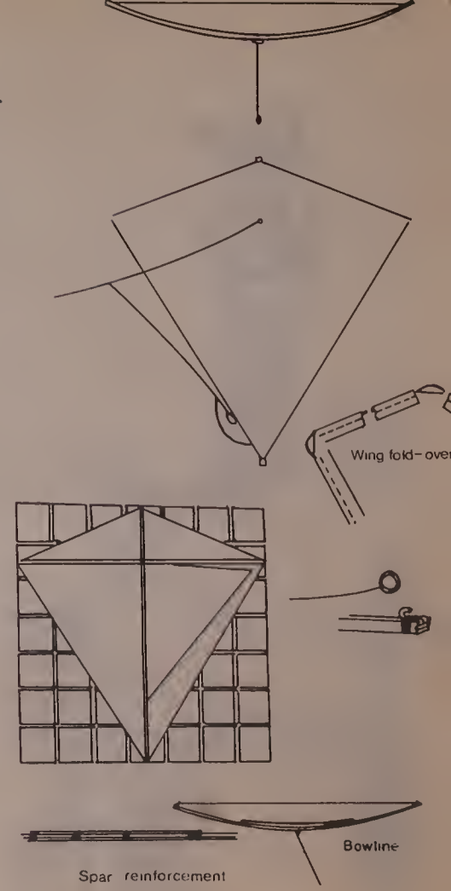
If you wish to have children paint their kites, silkspan or rice paper is the best covering, for it will take any water base paints for creative design work. It also has the added feature of shrinking when it dries, thus giving a very tight lifting surface for flying. Art goes along with utility in this instance.

Place your covering material flat on the floor and lay the frame on top, spar down on the material. Cut out the shape of the kite around the frame, leaving about two inches



of excess material for overlapping and gluing or taping.

Next, when all glue is dry or the kite covering is taped, you are ready for the bow string. Make a loop in a piece of linen thread or nylon fishing line. Hook it into a notch at one end of the spar and measure to the other side. Bend the spar into a curve as you would an archer's bow. Be careful not to break your spar by bending it too far. Make a loop in your bow line again and hook it into your other notch. Cut off the excess. You will now have a bow called a dihedral, an angle which helps your kite fly. A curvature 3-4" deep at the centre is usually sufficient. The same principle is used in aircraft wing designs. This bow allows your kite fabric to bulge up or pocket, thereby creating a very powerful and efficient lifting surface. If you are very careful in the construction of this kite, it may not require a tail to fly. Explain to your pupils at this point that if the kite has been constructed to the letter of the instructions it should fly without a tail. Ask them to test their handy work by attempting a tailless flight first, but the tail is part of the fun and aesthetics of kite flying. Add it on for the second flight. If the kite is not properly balanced when completed, a tail will be a definite necessity.



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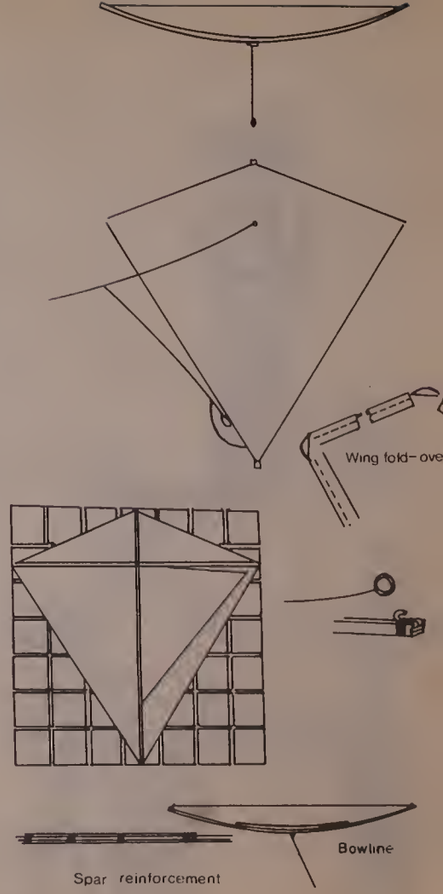


## Where to Fly Your Kite

Most schools have very large playgrounds. This should be the area first considered. Your second choice may be nearby parks. If these areas are not suitable, any open area where the kite can be launched without too many obstructions or fear of entaglement, will suffice. Remember you will have a class of children. Therefore numbers should be taken into account when selecting your flying field.

Large buildings, structures and big trees tend to cause turbulence. Therefore, avoid open areas immediately adjacent to these places. A good steady wind is usually found on open beaches, near hilltops and on long rising slopes. Avoid places close to highways, busy roads, and airport runway approaches.

In selecting the flying field, you should also be concerned with how the kites will be flown, i.e. kite fighting, aerobatics, sending up 'messengers' or just flying. Section off parts of your field and assign each group an area.

## Flying Your Kite!

Now comes the most exciting part of kiting--the launching. This is when the time and patience of building the kite is rewarded. If the launch is

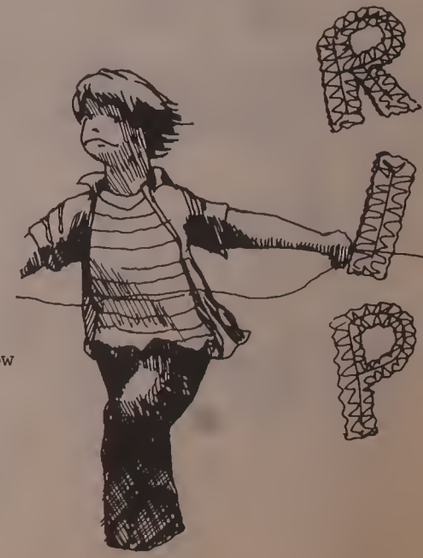


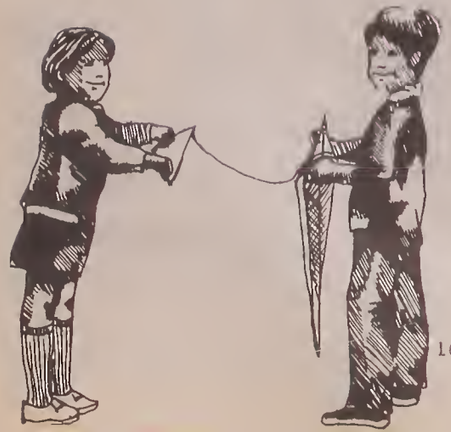
successful, the kite will soar and fly to any desired height or distance limited only by the wind, the amount of line you give it, and the weight of line the kite can lift.

There are two basic methods of launching. The first is the hand launch where you release the kite from your hand into the wind and let the line feed out as the kite rises. The second method is with a partner and about 25 to 50 feet of free line. The partner stands downwind holding the kite and the flyer pulls the kite into the air.

Running with the kite should be avoided or kept to a minimum, for it creates two problems. You cannot see your kite; therefore it may smash into the ground wrecking your work. Also, whether running forwards or backwards, obstacles become a hazard because you cannot see where you are going. You may even step on someone else's kite. Therefore, avoid as much movement as possible during launching.

Difficulty during the launch can also come from low level power dives and corkscrewing. A power dive is the situation you find yourself in when the kite goes into a nose down position and dives towards the ground. This speedy descent is aided by the wind, gravity, and tension on the flying line and the frantic pulling





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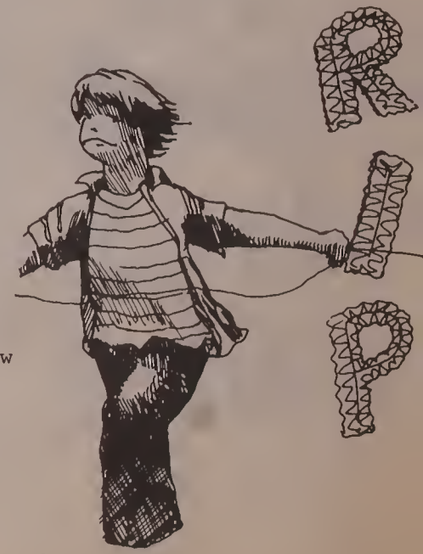


pulling of the flyer attempting to save the kite. The power dive can be corrected by releasing a lot of line quickly. This allows the wind to work with you by turning the kite around to a nose up position. As the kite "blows away" on the slack line, tension is restored and the kite will regain altitude. Let the pull of the kite determine how fast you let your line run out. If the kite pulls in quick jerks and loops let your line go as fast as the kite will take it. This usually prevents a power dive before it happens.

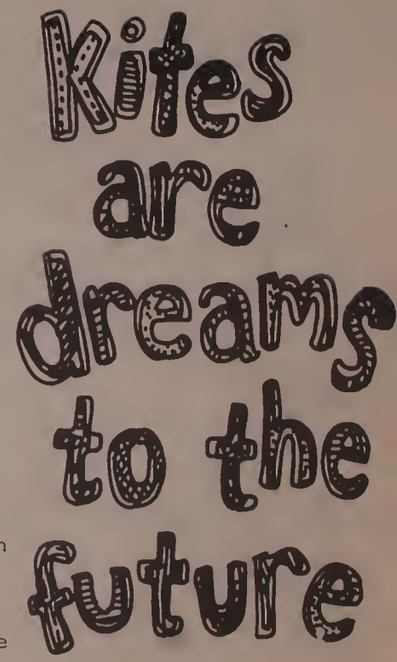
Corkscrewing is serious in that it usually involves other kites during a class fly-in. It can be corrected by letting out as much line as it will take to land it quickly, then add more tail. The problem must be solved quickly before other kites become entangled, otherwise multiple crashes inevitably result and the long tedious chore of unraveling begins. Sometimes it is easier to cut lines and count the tangled parts as lost, this will get kites back into the air faster. Trying to untangle lines in a wind on the flying field is just not worth the time and effort.

During a good launch, as the wind takes your kite, don't allow any slack, as this removes tension from the line and will cause the kite to lose altitude very rapidly. When you gain the altitude you desire, simply maintain tension and your kite will fly until the wind drops off or you pull it in.



In light winds, it may be necessary to 'play' your kite to gain height. This can be done by pulling on the line to make the kite climb, then play out line which will cause the kite to fall. Pull on the line again to restore tension and the kite will rise taking up the extra length of line. This operation can be repeated until the desired height is achieved.

With the problems of launching now over, you can get into all the activities that make kite flying enjoyable.




Flying Just For Fun

You may just want to lie down and watch the kite fly, letting the movement of the kite in the wind play with your imagination. What could be more peaceful?

Controlling Your Kite

Control of the kite usually depends on two things, the bridle and the tail. Much of how your kite reacts when it is flying depends on the arrangement of the bridle. Bridles can be one string, two strings, three or more strings. The bridle should be the type that suits the kite you are going to fly. The bridle distributes the strain of flying across the face of the kite. The more evenly

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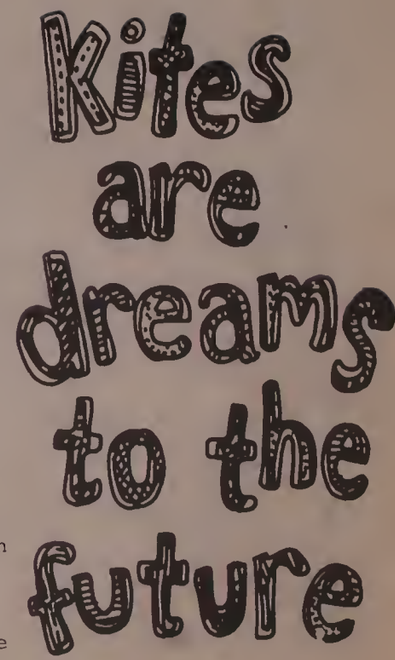
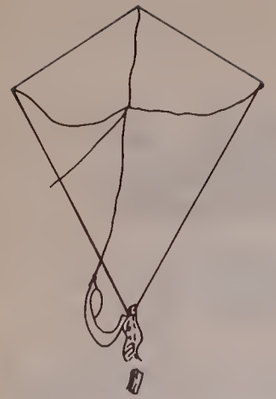
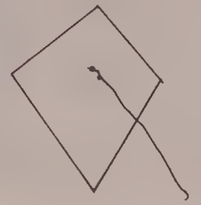


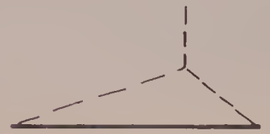


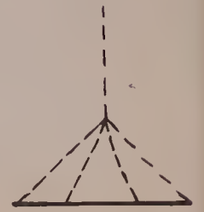
this strain is distributed the better the kite will fly. Small kites will fly with very little difficulty using two points of attachment; i.e., the Chiringa, small flat kites and smaller versions of larger kites.

The larger kites need bridles with more legs to spread flying strain and compliment the purpose of the frame.

Here are some bridle arrangements for the bow kite to show the possibilities.

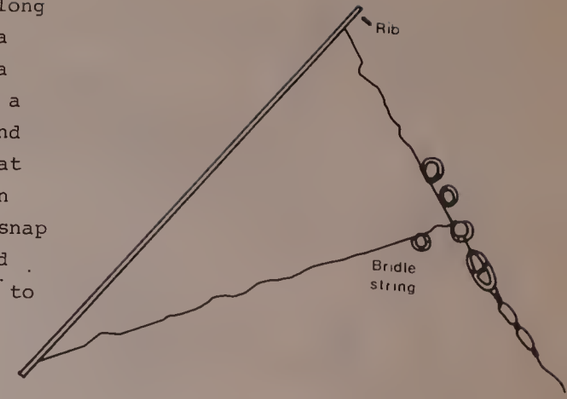








For the purist again, some helpful hints. Different winds require different positions along the bridle for best flying results. The extra time and care gives better performance; i.e. a little more height, more lift, ability to fly a kite when others are still trying to launch and so on. Drapery ring or split rings attached at 1" to 2" distances on the bridle saves time in finding the best flying positions. A swivel snap will make changing the position fast and avoid clumsy knots which take time to undo and tend to come undone at inopportune times.

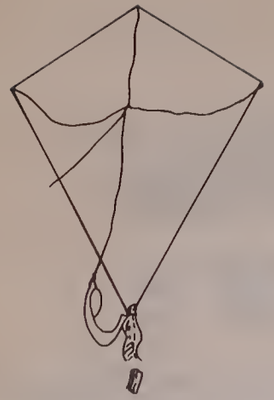



Use whichever type of bridle you find works best. I prefer the two legged bridle because it is the most practical for children.

In three and four legged bridles, make sure all legs are the correct length. A leg that is too long or too short will pull unevenly on your kite making its flight erratic.

The Tail Of The Kite

If your kite flies erratically, it may need a tail or a longer tail. A tail adds the necessary drag to balance your kite and keep it going in the right direction--up. It stablizes the angle of attack for the kite. Add to or take away from the



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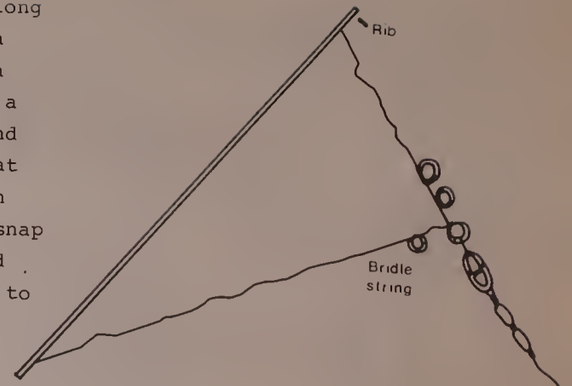

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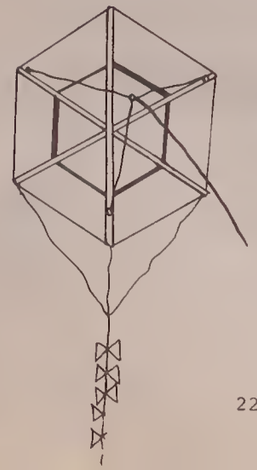


tail as wind conditions dictate. Violent twisting is the usual indication of not enough tail and inability to climb usually means too much tail.

For the flat kite the tail is almost as important as the kite itself. A simple rule for length, the longer the better. This long tail should bring out the creative instinct in your students -- make them as decorative as possible.

For other kites that require a tail the materials available are endless: crêpe paper cut into strips across the roll ends; flourescent plastic survey tape ($1.00 a roll); plastic bags; newspaper twisted into bows, tissue paper, plastic lids from small containers; old nylons and anything else that is lightweight and decorative.

Remember be generous with your tail, its purpose is to add drag for balance not weight. If the tail is too heavy, tear or cut a little off.

The sight of 20 or 30 kites flying in the space over a field or park can be enhanced by the variety of tails as well as the kites themselves.

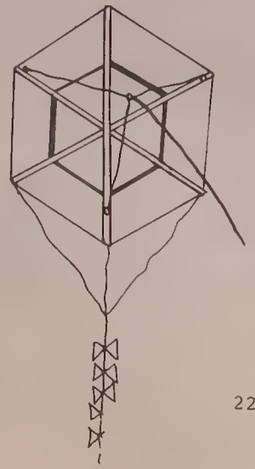
Aerobatics

When the desired altitude is reached, you are now ready for simple aerobatics. By a continuous steady pull on the line the kite will climb to the zenith, 90 straight



overhead, where it will then nose over and begin looping down. By moving a few steps backwards into the wind and quickly taking up the slack, control can be regained and you can repeat the exercise. This is a good stunt to start with. It involves flying the kite as high overhead as possible, using the method mentioned earlier, for gaining altitude in light winds, having the kite lose its flying ability and then making a recovery all without danger of crashing.

Power diving at high altitudes can be a breathtaking stunt. Permit the kite to climb to a reasonable height, not too high or the string will be too heavy for the response you want. Strip about 20 or 30 feet of line from your reel and let it lay on the ground in big loops in front of you. Let the line go five or ten feet at a time. This instant slackening of the line will be felt immediately by the kite usually producing erratic flight, or loss of flying angle. As the kite turns nose down, pull hard on your line and a power dive should result, if not use another 5 or 10 feet of the line at your feet and try again. There should always be enough line at your feet to recover your kite from its stunt. Once into the power dive, recovery can only be effected by giving a lot of slack to the kite to allow it to recover itself. By playing with slack and tension other stunts can be performed.



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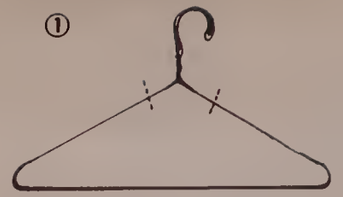
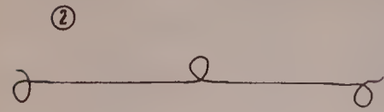
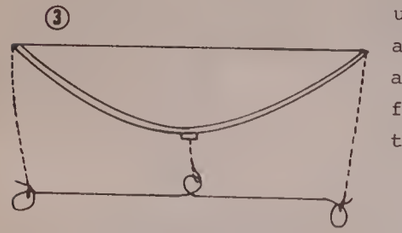


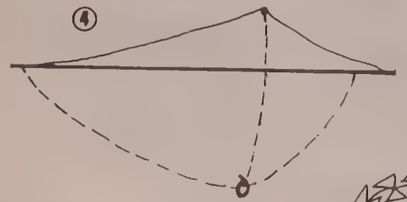

More complicated aerobatics can be performed with a twin line arrangement. A coat hanger is all you need to start this project. (See illustration.)

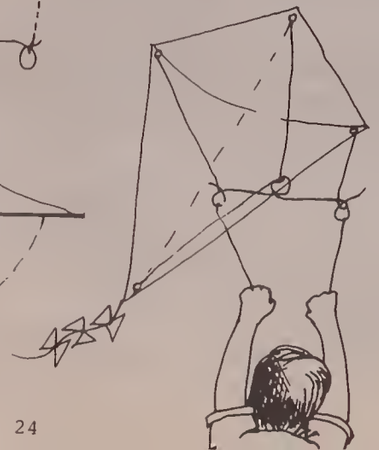
Attach to bridle on a bow kite as in the illustration.




This arrangement more than any other will give the flyer far more personal contact with his kite. An instant and dramatic response to the slightest movement of the hands occurs at once. This kite is very difficult to hand launch without a very complicated reel. To launch, place the kite upside down on the ground and then lay out the two lines about 100 to 150 feet or whatever your flying field will allow. Stand between the two lines, about 15 to 20 feet from the kite holding one line in each hand, gently pull the kite to a standing position on its tail. When the wind catches the kite, pull down on the lines to make the kite climb. As it rises and takes up flying tension walk back along your lines until you reach your reel. Up to this point there is little danger of tangling your lines. Spread your arms and you are now in control of a highly maneuverable kite. Good luck and don't tangle your lines. (Use nylon monofilament line for this





kite as it does not have the tendency to tangle the way strings and threads do.)

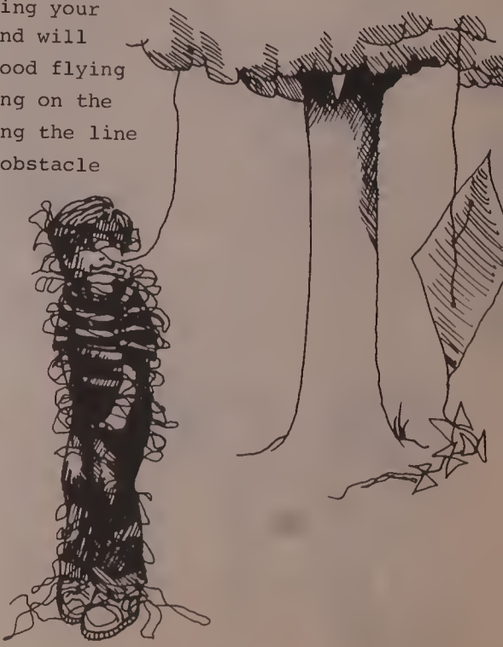
Trees, T.V. Aerials and Other Hang-Ups

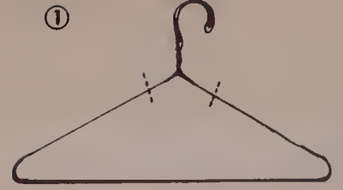
When your kite runs afoul of one of these obstacles release 10 or 20 feet of line immediately. This should prevent your kite from impaling itself and tangling your line thereby making recovery impossible. The wind will now work for you by turning the kite back to a good flying position. If a tangle occurs or the kite is lying on the outer leaves, leave your line slack and walk along the line until you are in a position close enough to the obstacle to try the following:

1) gently tug the line to see if the kite will catch the wind and lift. If successful, break your line and let the kite pull itself free. Without the tension of being held, it will float to the ground on the other side of the obstacle.

2) If tangled and still flying above it, try breaking the line as high as possible, but not by pulling. The kite will usually work itself free on its own. Pulling only tightens tangles on both sides of where it is caught making any chance of recovery impossible.

3) If the kite is tangled, impaled, buried



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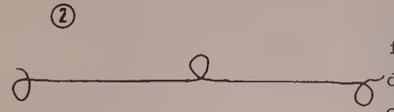


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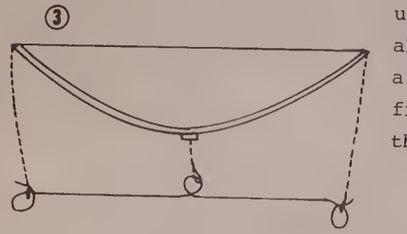


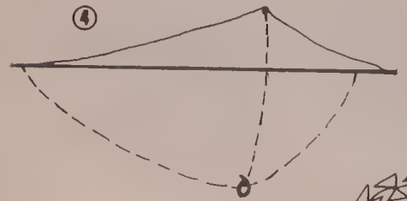


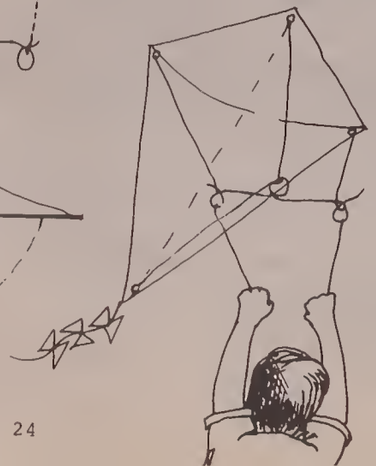



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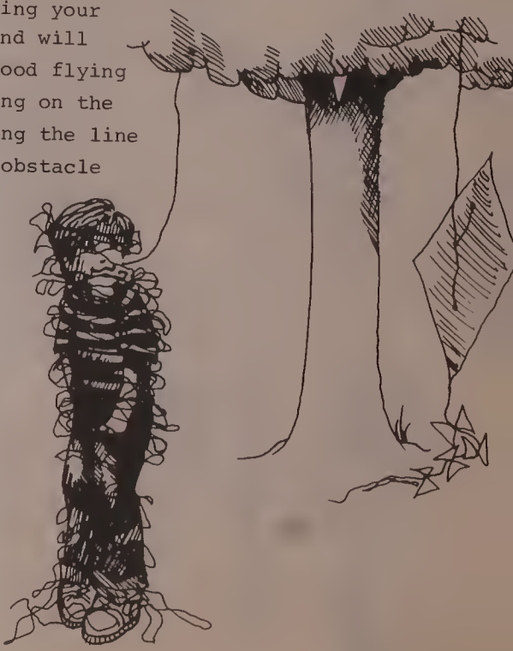


into the tree or any combination of these three, leave it. A kite is not worth the danger of climbing to retrieve it.

4) Keep in mind this simple rule - When in doubt; don't pull.

> Caution
>
> Never fly your kite in the vicinity of powerlines. But if your kite does tangle in powerlines drop your cord immediately. Under no circumstances should there be any attempt to retrieve a kite tangled in wires. Only grief can result either by a bad fall through climbing or by an electric shock, particularly if the kite is wet. Wet flying line is an excellent conductor of electricity to the ground as are poles and other gadgets that might be used to free a kite. Do not pull on a kite to retrieve it from powerline tangles. You may cut through the insulation to the live wire or pull two wires together and blackout the neighbourhood. T.V. aerials are also a hazard. There is a danger in pulling older ones down. Permit no wire flying lines or lines with metal centers. Remember, grown-ups as well as children have been killed trying to free a kite from powerlines.

## Kite Fighting

There are two basic methods of kite fighting: cutting your opponent's line and maneuvering your kite in such a way as to smash your opponent's kite and break it up.

Before permitting kite fighting you should set down rules for the participants. Be very sure that your students understand the rules and that there is agreement by all



participants before starting. Set aside part of your field for fighting only. Have it clearly understood that only those who are fighting are bound under the rules. Kites that stray into wrong areas are not bound by the rules of fighting but any damage resulting to a stray kite is the responsibility of its owner.

## Combat Rules

(1) The kite that is cut down in flight is the loser and if agreed beforehand, becomes the property of the winner.

(2) If two kites tangle, the kite that loses its flying ability will be declared the loser if the owner cannot regain control within a reasonable time. (approximately two minutes).

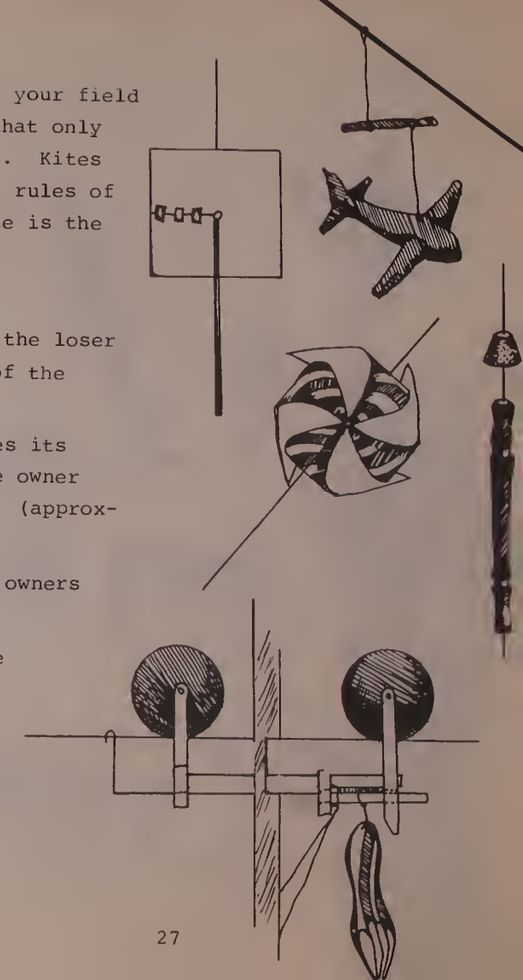
(3) Crashed kites will be cleared by their owners immediately.

Vary these rules to suit your needs and the children's needs.

Fighting can be a test of all the skills children learn from kiting, their ability to build a strong durable kite and their skill in handling it.

## Messengers

A great variety of objects and gadgets can



into the tree or any combination of these three, leave it. A kite is not worth the danger of climbing to retrieve it.

4) Keep in mind this simple rule - When in doubt; don't pull.

**Caution**

Never fly your kite in the vicinity of powerlines. But if your kite does tangle in powerlines drop your cord immediately. Under no circumstances should there be any attempt to retrieve a kite tangled in wires. Only grief can result either by a bad fall through climbing or by an electric shock, particularly if the kite is wet. Wet flying line is an excellent conductor of electricity to the ground as are poles and other gadgets that might be used to free a kite. Do not pull on a kite to retrieve it from powerline tangles. You may cut through the insulation to the live wire or pull two wires together and blackout the neighbourhood. T.V. aerials are also a hazard. There is a danger in pulling older ones down. Permit no wire flying lines or lines with metal centers. Remember, grown-ups as well as children have been killed trying to free a kite from powerlines.

## Kite Fighting

There are two basic methods of kite fighting: cutting your opponent's line and maneuvering your kite in such a way as to smash your opponent's kite and break it up.

Before permitting kite fighting you should set down rules for the participants. Be very sure that your students understand the rules and that there is agreement by all



participants before starting. Set aside part of your field for fighting only. Have it clearly understood that only those who are fighting are bound under the rules. Kites that stray into wrong areas are not bound by the rules of fighting but any damage resulting to a stray kite is the responsibility of its owner.

## Combat Rules

(1) The kite that is cut down in flight is the loser and if agreed beforehand, becomes the property of the winner.

(2) If two kites tangle, the kite that loses its flying ability will be declared the loser if the owner cannot regain control within a reasonable time. (approximately two minutes).

(3) Crashed kites will be cleared by their owners immediately.

Vary these rules to suit your needs and the children's needs.

Fighting can be a test of all the skills children learn from kiting, their ability to build a strong durable kite and their skill in handling it.

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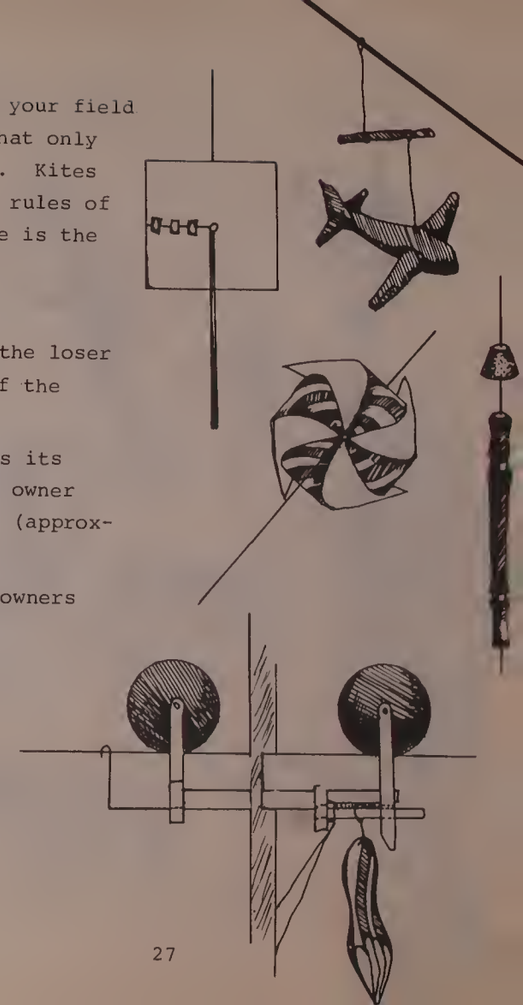
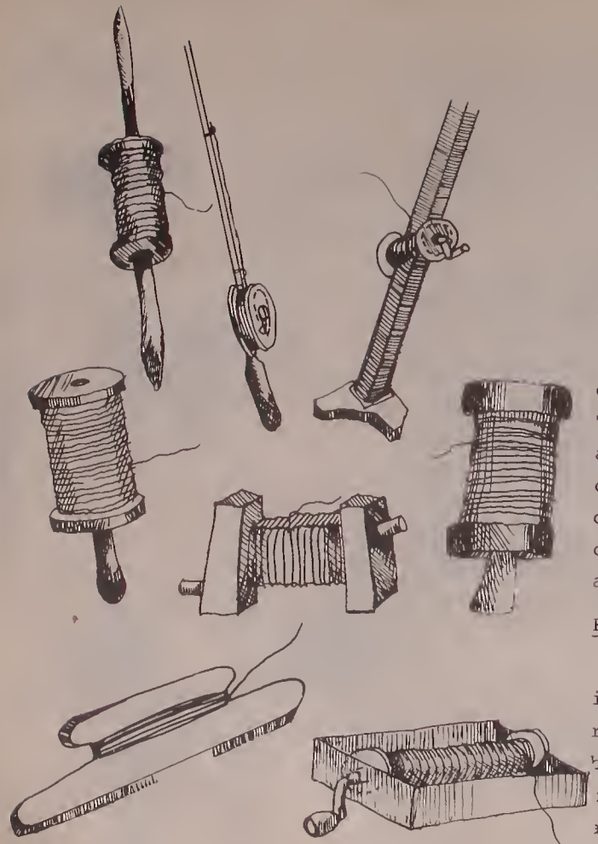




be sent up on your kite line with the help of the wind. Paper sails, paper pinwheels, straws and gliders will climb very nicely when placed on the line. More elaborate messengers and pulleys and a release device for gliders, sails, parachutes and bombs can be built. These messengers release their cargo and slide back down, where they can be reloaded and sent up again.

In all cases, a 'stopper' (corks are excellent) should be used on the kite line. This will prevent the tangling of the bridle and provide a suitable release point for cargo drops. Things to send up are limited only by weight, but don't send anything up on the line to be released that you can't afford to lose or you don't want to clean up.

Retrieving:

When you're finished flying, retrieving is your next task. What type of take-up reel is best? Anything which your line can be wound onto or into conveniently. Large cardboard tubing which you can put your arm through is fast and cheap, or a simple wooden take-up can be cut from 3-ply plywood



or hardwood. (See illustration p. 30.) Trolling reels and homemade winches are also very good for kites of any size, casting reels are good for lighter kites.

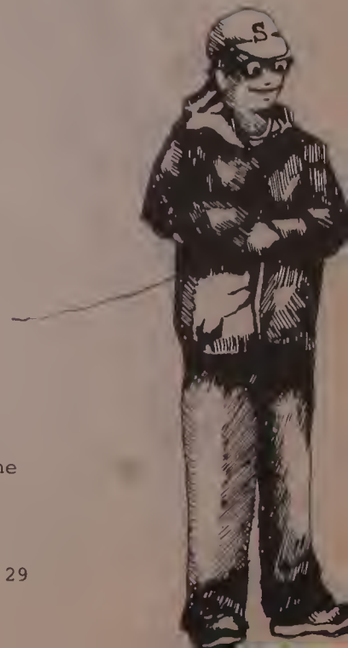
Care should be taken when bringing down your kite. Too much tension might break your line or kite on windy days. Some kites, particularly the larger ones, will require two people to retrieve them, or will at least make it much easier. One person can haul on the line while the partner winds the line on the take up reel.

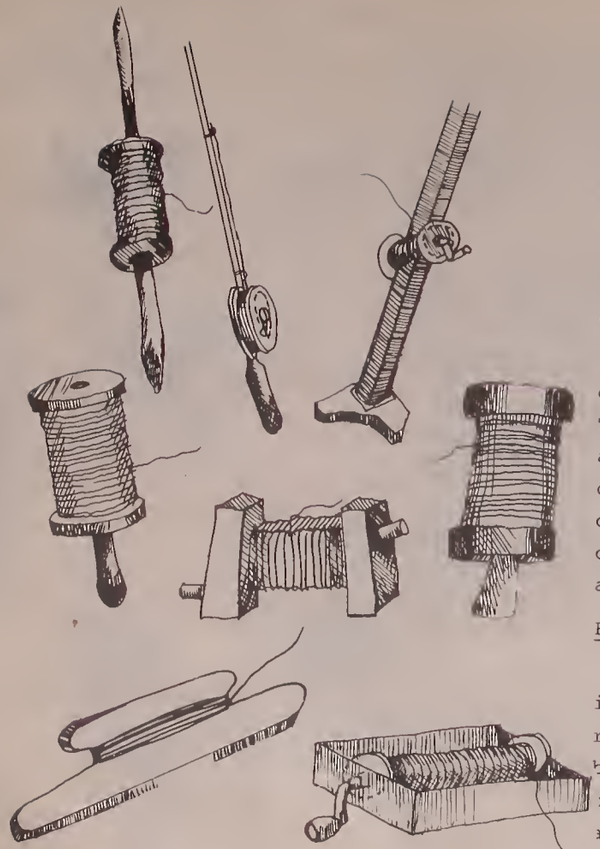
Walking your kite down

The quickest method of retrieving a kite is to tie your line to a post, something solid, or just hand your reel to a friend. Place the line under your arm, and if the field is long enough walk the kite to the ground. This saves sore hand muscles from trying to wind in line under flying tension. If your field is not long enough, after the first walk, return to your original position, retie your line to the post or whatever and repeat the process until the kite is down.

Wind conditions and the size of the kite will determine the best method of bringing your kite down. If you are using braided or twisted cord, you must take up the line under tension or it will twist and knot very quickly, particularly if two people are bringing the kite down and







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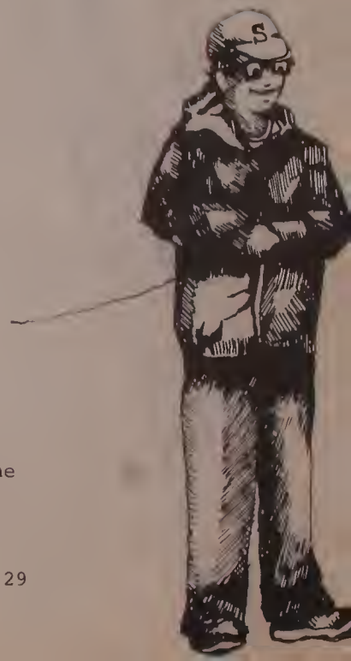
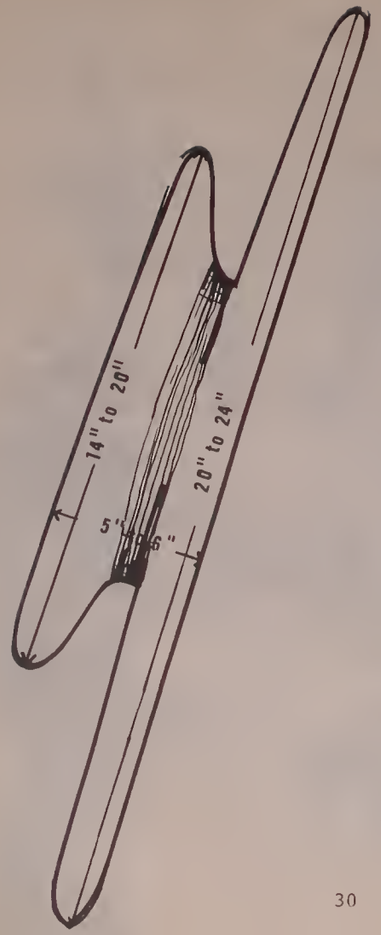





the partner reeling in is not fast enough. This is also a good time to watch for obstacles as the wind is more turbulent close to the ground.

Your kite can go through some fairly violent gyrations at this point. For smaller kites, give your line a lot of slack to make it drop or float just before touching down. This works very well and will produce smooth landings.

An excellent reel can be made from scrap wood by using this pattern. By holding onto the long points your line can be released quickly and easily by alternating your wrist motion towards the kite. Retrieving is fast, 24 to 36 inches of line can be wound up for each motion. Hold onto the short points and use the long ones to catch your line.

Repair

Any group situation where a lot of kites will be damaged (from minor breaks and tears to total demolition) demands a handy repair kit with basic materials in it, i.e. needle and thread, mending tape, scotch tape, plastic tape, and scissors.

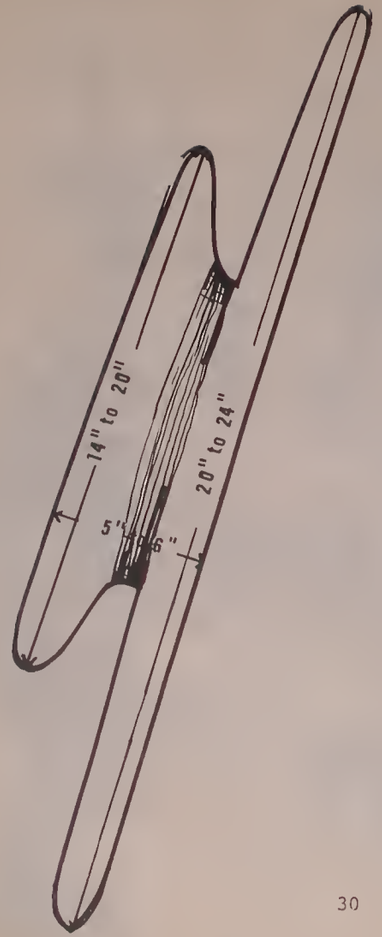
If there is a weakness anywhere in the kite, it will probably show up on the first flight. This will be followed by wild gyrations, then a crash. Close inspection may turn up loose fittings, seams or tape pulling loose, cracked



spars or keels and so on. These minor problems can be cleared up out on the field. Major repairs will usually have to take place in the classroom where complete rebuilding can be done. When repairs are made, take care to maintain the balance of the kite. Whatever you add to one side should also be added to the other side. If a spar or keel is badly cracked or broken, repair can sometimes be effectively made by reinforcing the damaged area with bamboo strips. Tape is very effective for the repair of most damage to a kite. The darning needle and thread are handy because they make possible repairs in areas where paper, plastic or cloth is glued to the frame. The needle punctures a small hole close to the frame and pulls the thread through thus eliminating large cuts and taping on the lifting surface or coverings. This is particularly important with box kites and their related types.

What To Take To The Flying Field

First, don't forget to take your kites and line. Second, take everything in a box that is on the basic list of supplies for construction and repair. Finally, good luck. You may just have a chance to fly your own kite between supervising repairs, answering questions as to why kites won't fly and settling disputes over tangled flying lines.

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## HISTORY OF KITING

It is not known who invented the first kite or where it was flown. Probably kites originated about three thousand years ago in the Orient. The Chinese are reported to have routed an attacking army by attaching noise makers to their kites and flying them over the enemy camp at night. Tales of kite flying can also be found in Egyptian hieroglyphic records dating back 2500 years. Where would Benjamin Franklin have been without his kite? A new use for the kite was developed by Alexander Pocock, an Englishman, who used kites for towing carriages along the English highways of the early eighteen hundreds. Captain B.S.F. Baden-Powell, brother to the founder of the Boy Scouts, used his man-carrying kite for an aerial observation platform. Alexander Graham Bell, inventor of the telephone, worked extensively with kites in an attempt to discover a practical means of manned flight. And the Wright brothers, who succeeded in achieving a workable design for powered flight, did so by the use of kites. Marconi used a kite to lift his wireless aerial when he sent his radio message across the Atlantic. Kites have entered extensively into weather prediction also.

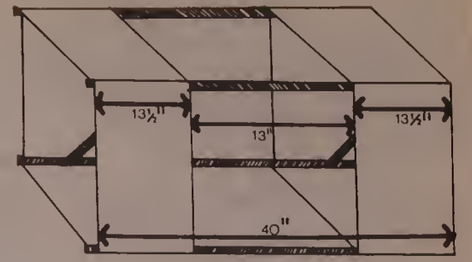
New designs for kites brought new uses into existence. The box kite, invented by Lawrence Hargrave in the 1870's, brought stability plus lifting power to the kite. For many years, Hargrave's box kites were used by meteorologists in studies of the weather until improved balloons made them obsolete. The U.S. Weather Bureau still maintains the world's altitude record for kites at 31,955 feet, a little over six miles high. A kite without rigid support, the Rogallo Parawing, was invented in 1943 and has been proposed, with power added, as a means of returning manned space vehicles from earth orbit. The Parafoil is a kite made entirely from fabric, without rigid supports. This design, a wing shape with the air passing through the kite as well as around it, is widely used for weather study and recording.

Kites have also been used for military purposes. During the U.S. Civil War, kites were used to drop propaganda leaflets over Southern troops. The British used kites in the Boer War and in World War I to lift observers who located and mapped movements of enemy troops. And the Germans, during World War II, developed a man-carrying autogyro kite which was towed behind submarines on sea duty. The observer reported by telephone the movements of ships over the horizon to the submarine's deck.

Kiting is by no means obsolete today, as a bright windy day and an open park will show.



## APPENDIX OF KITE TYPES

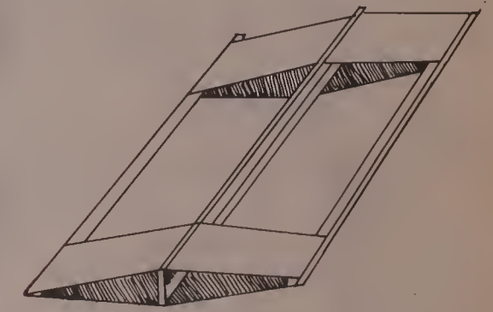



### Kites That Won't Fly

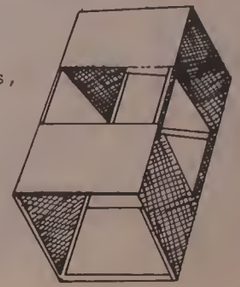
Don't throw away reluctant kites. If they won't fly, painting or colouring will turn them into bright and gaudy hall and room decorations.

### Box Kites

To save weight, use notched cross braces to hold the flying surfaces of this kite open. Make sure each brace (four needed) is at least 1/4" to 1/2" longer than the diagonal distance between the longerons, as this will provide the pressure needed to form the box shape of your kite.



This kite flies best in a good stiff wind. Be sure and wear gloves or bad cuts will result from the line being pulled out too fast during gusting wind conditions. It is a lot like fishing, for you can let your line out - without burning your hands - but when that salmon strikes, watch out!



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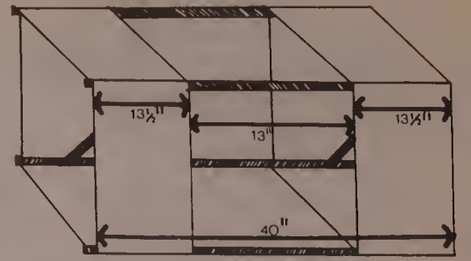


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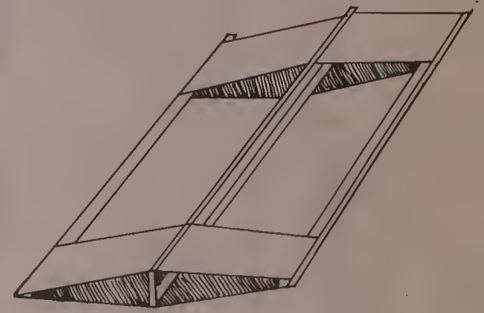

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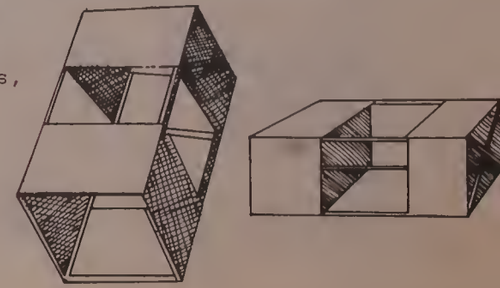

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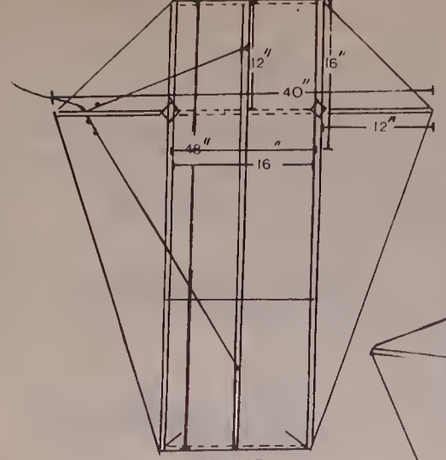

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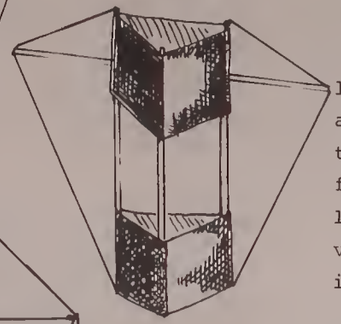
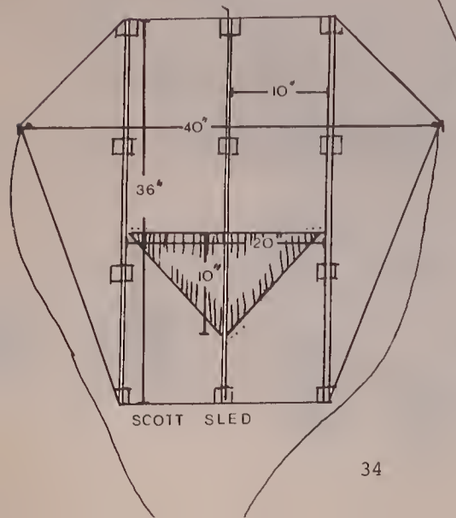




SCOTT SLED

bridle will give you horizontal movement back and forth across the sky. Spectacular power dives can be brought about by playing with slack and tensions. Be sure you have proper altitude for stunting these birds; otherwise there will be splinters and waste paper everywhere.

Box Kite Variants (Triangular Box, French Military [Coyne] Kite)

Winged boxes give an added challenge and thrill to kite flyers. The added lifting surface will definitely tax the ingenuity of any ardent kite flyer. The wing spars should be at least 1/4" spruce or dowling to prevent bending and breaking. Tie spars inside the longerons for wings.

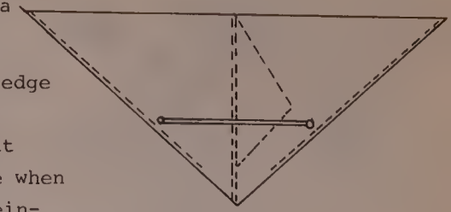
Remember, as with the box kites, power dives with a winged box will be faster and much harder to correct. Give slack immediately. Do not pull.

Scott Sled

Here is an easily hand launched kite. Once airborne, your sled will climb just as fast as you give it line. (Be sure to wear gloves for this one.) Do not allow any slack. This kite has a peculiar tendency to invert itself and then power dive when too much line is played out too fast.

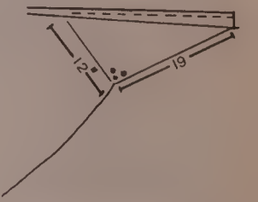


Double reinforce your bridle attachment points with plastic tape. If possible, put in a metal eyelet, as a lot of strain is born at this point on your kite.

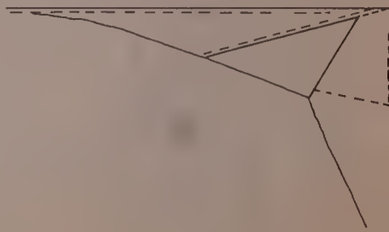


When cutting your plastic with scissors, nip the edge and then push. This will give you a cleaner cut than snipping all the way across. Those little "teeth" that result from a sloppy cut add unwanted drag. Take care when cutting the vent. If the triangular shape is used, reinforce the three corners with a little tape. If your vent is circular, so much the better.

Retrieving this kite has proved to be a problem because of strong drag and ground looping when close in. With a partner to hold your reel, run with the line under your arm (be sure you have a jacket on) to get your kite down quickly. Remember your instructions for landing kites.

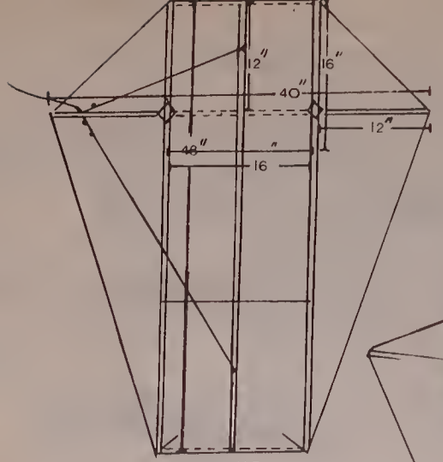



The Scott Sled is quick and easy to build and is even easier to fly. It is highly recommended as a first kite to give students an early feeling of success in this unit.



The Bat Kite

Precision makes this kite fly. For small bat kites, use the lightest material that you can obtain. Laundry bags and small quart capacity garbage bags such as those used under the sink are good. If electrician's tape is



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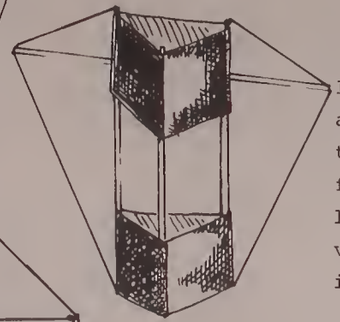


bridle will give you horizontal movement back and forth across the sky. Spectacular power dives can be brought about by playing with slack and tensions. Be sure you have proper altitude for stunting these birds; otherwise there will be splinters and waste paper everywhere.

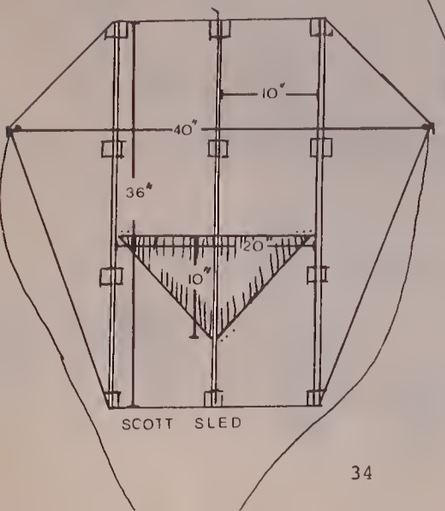
Box Kite Variants (Triangular Box, French Military [Coyne] Kite)

Winged boxes give an added challenge and thrill to kite flyers. The added lifting surface will definitely tax the ingenuity of any ardent kite flyer. The wing spars should be at least 1/4" spruce or dowling to prevent bending and breaking. Tie spars inside the longerons for wings.

Remember, as with the box kites, power dives with a winged box will be faster and much harder to correct. Give slack immediately. Do not pull.

Scott Sled

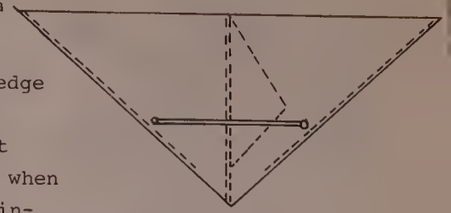
Here is an easily hand launched kite. Once airborne, your sled will climb just as fast as you give it line. (Be sure to wear gloves for this one.) Do not allow any slack. This kite has a peculiar tendency to invert itself and then power dive when too much line is played out too fast.



SCOTT SLED

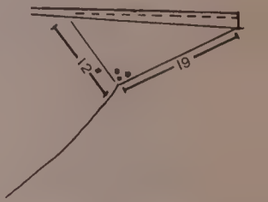


Double reinforce your bridle attachment points with plastic tape. If possible, put in a metal eyelet, as a lot of strain is born at this point on your kite.

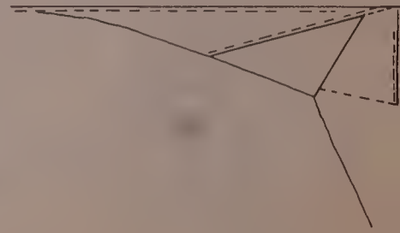


When cutting your plastic with scissors, nip the edge and then push. This will give you a cleaner cut than snipping all the way across. Those little "teeth" that result from a sloppy cut add unwanted drag. Take care when cutting the vent. If the triangular shape is used, reinforce the three corners with a little tape. If your vent is circular, so much the better.

Retrieving this kite has proved to be a problem because of strong drag and ground looping when close in. With a partner to hold your reel, run with the line under your arm (be sure you have a jacket on) to get your kite down quickly. Remember your instructions for landing kites.

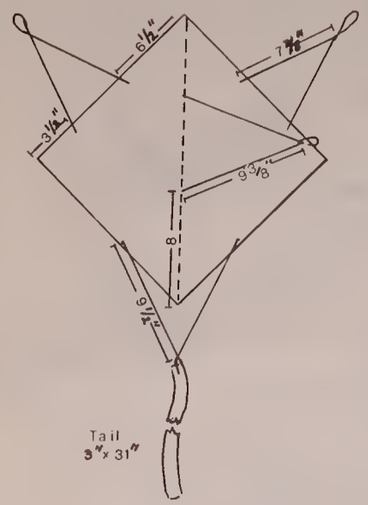


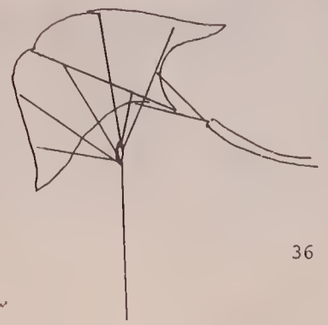

The Scott Sled is quick and easy to build and is even easier to fly. It is highly recommended as a first kite to give students an early feeling of success in this unit.



The Bat Kite

Precision makes this kite fly. For small bat kites, use the lightest material that you can obtain. Laundry bags and small quart capacity garbage bags such as those used under the sink are good. If electrician's tape is



used, use it sparingly as too much weight will quickly put your kite out of balance. Just try and get some of this tape off and most of the plastic bag immediately adjoining will come with it. Get your more ingenious students to try the hot iron method. The right heat, tin foil or wax paper and the right touch and you will have a heat bonded seam that will save a lot of weight. (Try some old scraps first.)

Non-Rigid Kites

Here is a challenge. Fly a kite without a frame! Use what you can find--mylar, plastic, tinfoil (heavy duty or light weight), silk scarves, or anything else that you can obtain. Most of these kites can be made by folding, creasing or cutting to exact measurements. Your material alone is the lifting surface--no frame is needed.

The Chiringa is a square piece of paper, which if accurately folded and bridled it will fly extremely well. The Parawing depends on its centre crease for stiffening to maintain shape and flight. The Parawing and Parafoil will fly, but perhaps should be a class project for an eager student with a good sewing machine.

Parachute Kite

This is a good kite for light winds. Gentle pumping on the kite string will make this kite climb rapidly to



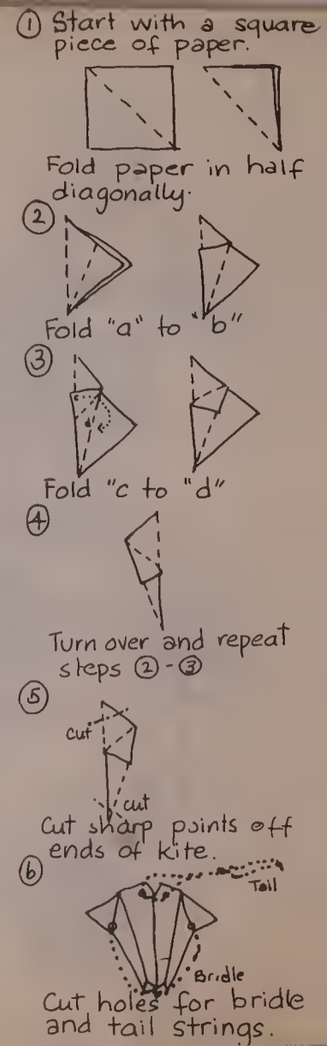
a good flying height. The pumping fills the canopy with air, giving drag which makes the parachute climb. The slack given during pumping pulls out line as the kite falls into the wind. The next 'pump' repeats the process.

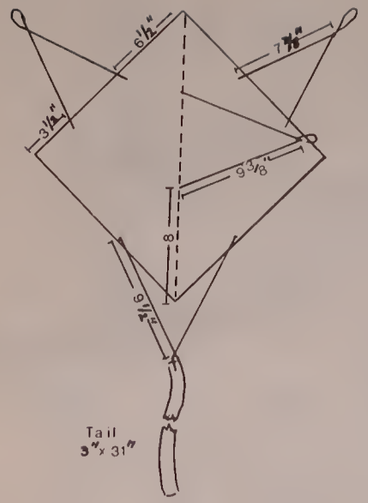
The Chiringa

A square piece of gaudy paper, multi-coloured tail paper, needle, thread and scissors are all that is needed for this kite. Simple to make and a treat to fly, the Chiringa will be long remembered by your students as the impossible becoming the possible. During construction as a group activity in my class, very few pupils felt it would fly. The doubts lingered until the armada of thirty odd Chiringa's filled the sky above the playground. The comments from the pupils after the class returned to the classroom ranged from "How big can you make one?" to the picture presented by the sight and colours.

Paper folding: On the first fold, make sure there is no overlap. If there is, trim off the excess. All folds should be neat and trim. Thread the needle, then punch your holes for the bridle, pulling the thread through and tying off the ends. On your bridle loop, be sure it is just long enough for the nose of the kite to pass through. Some Chiringa's prefer to fly nose down. Use the same method for punching holes for your tail with the needle and thread. If you don't have a needle punch holes with a pin, nail







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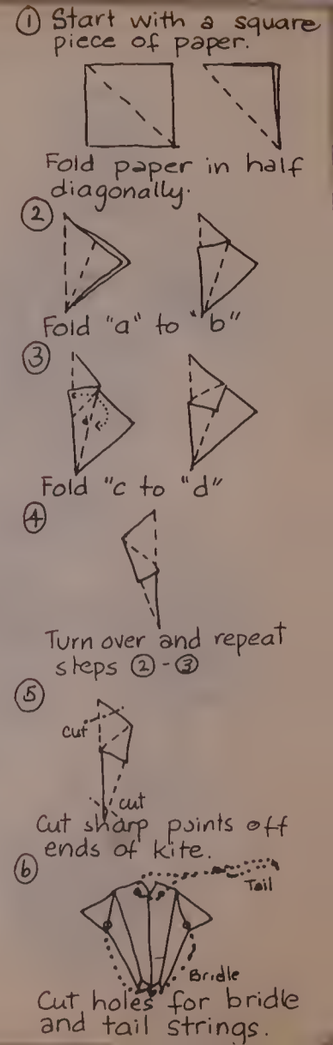
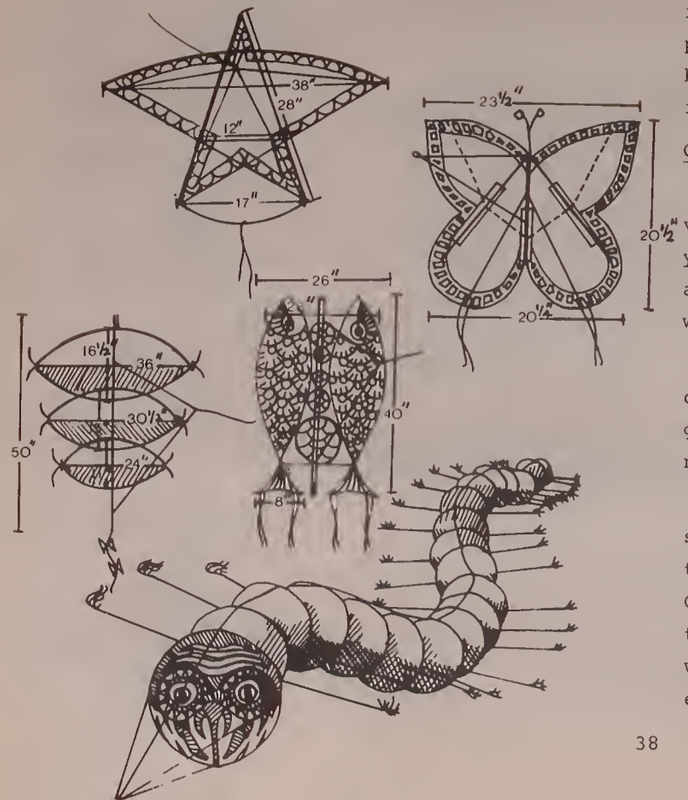





and/or other pointed objects and then push the thread through with them.

Don't neglect your tail. Make it as colourful and long as you possibly can. The reward from this kite will be the display it provides for the watchers as well as the flyers.

Chinese Design Kites

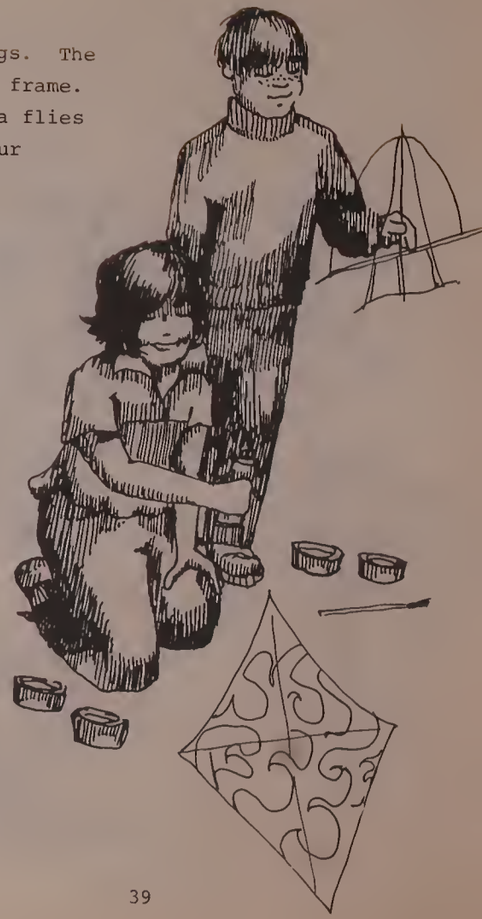
These small kites are perhaps the very best way to finish this unit. If your students have learned anything about why kites fly, here is where it will surely be put to the test.

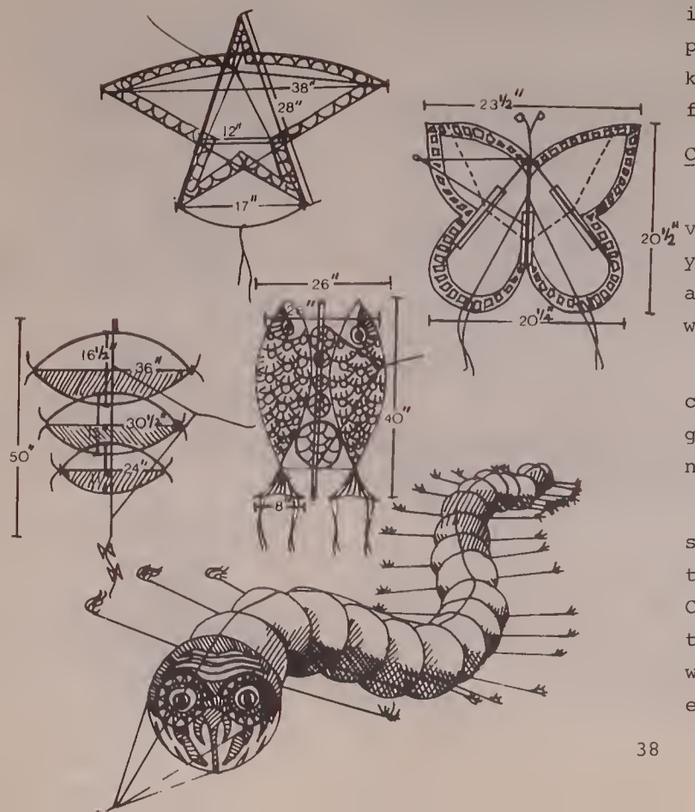
Here the key is light weight, where coverings compliment the frame, each giving the other the strength that is needed for the kite to fly.

Split your bamboo curtain into smaller strips 1/4" to 3/8". From these strips, the frame is then made. Caution the children that only one or two turns of thread are needed along with a dab of glue. Check balance at every step. Rice paper, silkspan,



or tissue paper will make excellent light coverings. The paper when glued will then act as support for the frame. Save weight in the frame. After all, the Chiringa flies by paper folds alone. Therefore, the frame on your Chinese kite can and should be used for design.



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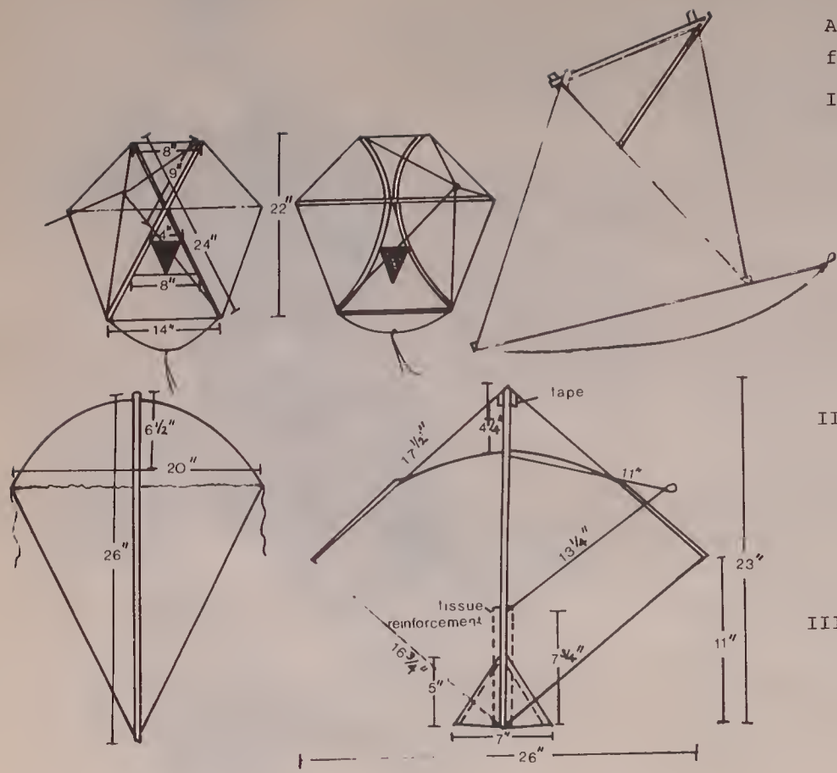


Appropriate wind conditions for various kite types.

I Zero velocity to 7 mph plus
- -parachute kites
- -bow and double bow kites
- -scott sled
- -bat kite or Delta wing
- -Rogallo parawing
- -cardboard paper kite or Chiringas
- -flat two sticker
- -chinese design kites

II Moderate winds: 5-10 mph plus
- -large bow kites
- -Bermuda kites
- -Stub nose kite
- -rectangular Japanese
- -tailless Malay (eddy)

III Winds 10 mph and over
- -box kites and multi celled kites
- -barrage kites
- -Jalbert Parafoil
- -French military or Coyne kites
- -Tetrahedral kites
- -Dragon kites



APPENDIX B

Handy Materials for Kite Building

Frames, joints, ties.

* Avoid nails, brads and tacks; this weakens your frame.

a) Bamboo (which you split yourself)
- Pine
- Spruce
- Ash
- Cedar (fence pickets, driftwood)
- Orange crates (cut into strips)
- Mahogany veneer
- Bamboo garden stakes
- Green Japanese Bamboo from the garden (some drying needed for strength)
- Soda Straws
- Old knitting needles (excellent for square kites)
- Stiff plastic

b) Linen thread (must be cut) for tying joints and cross connections
- String, fish line, thread (ordinary) for outline outside the frame
- Glue (Bond fast)
- Flexible plastic tubing for corners on plastic frames
- Dowling (very strong)
- Take-up reels: plywood, large diameter heavy cardboard tubes, fishing reels, (trolling reels for large kites).

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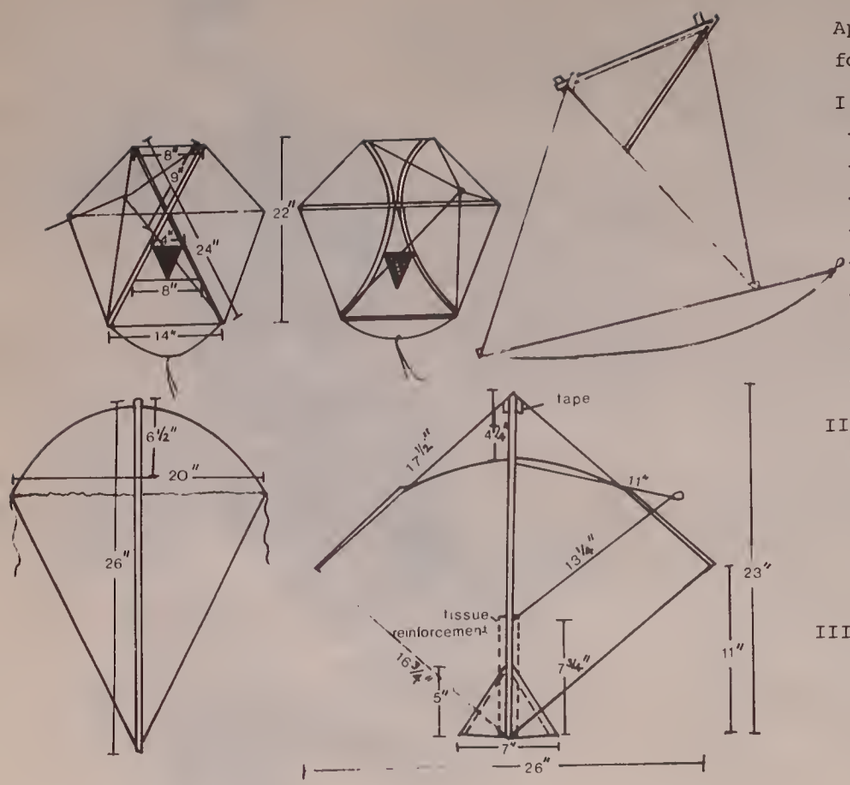


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Easily home manufactured winches from wire spools

c) Where to get your materials:

Army and Navy Department Store for nearly everything

Scrap heaps at back of lumber companies

Cedar logs on beach (driftwood)

Letter home to all parents with the above list for donation to the school

Purchased kites for redesign (time saver)

Chinatown for bamboo curtains and rattan

Covering

a) Paper of almost any weight that will not tear when subjected to vigorous pulling.
Paper with rag content or long fibers (tear a corner to test), rice paper or silk paper (type used for model planes)

b) Plastic - dry cleaning bags (weak)
- garbage bags (very good but do stretch)
- heavy construction plastic 6 mil. and up
- Mylar (excellent but expensive)
- decorated shower curtains, table cloths, etc. (heavy)

c) Cloth - ladies' head scarves (silk or synthetics)
- kite cloth Zephrlite (expensive)
- plastic coated cottons
- synthetics such as nylon and rayon that are tightly woven

Kite Lines and Accessories

*Fishing line - strength should increase with the size of kite



- string (tends to knot badly if not retrieved under tension
- kite string
- fishing rod, trolling reel (takes time)
- swivels with hooks
- wooden take up reels: takes up 3 feet of line per complete turn - long points used to catch line. Points must be ON SAME SIDE or you will get wound up in the line.
- split rings
- needles (darning) used for making small holes in kite material close to frames for linen thread
- drapery rings
- eyelets and punch - reinforcing and preventing tearing
- plastic tape - reinforcing and joining, attaching, etc.
- adhesive tape - quick patches
- sharp cutting knife - splitting bamboo and anything else
- pliers
- scissors
- clothespins for holding

Tapes

- sticky tape
- scotch tape
- plastic electrician's tape
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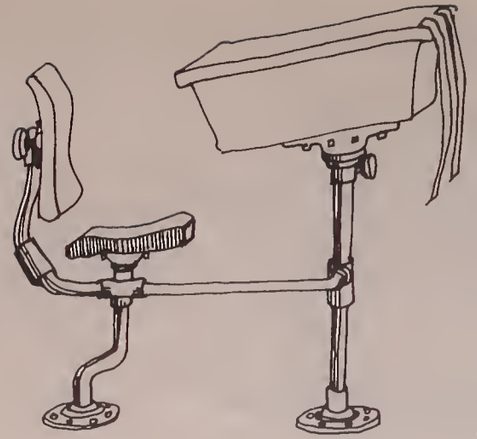

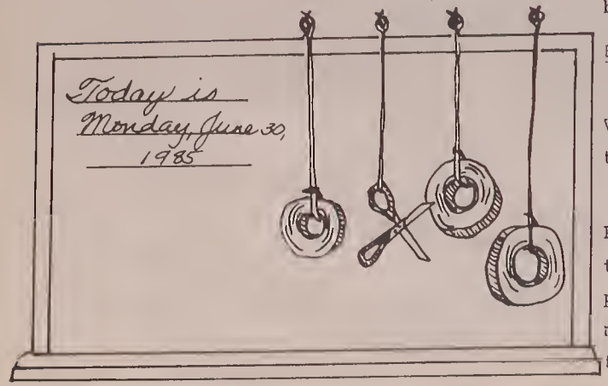


Tape Tips

The easiest way to handle Scotch tape, sticky tape, electrical tape and masking tape is to give each child enough in one strip to complete their kite. Hang the allotment on the edge of the desk, the necessary short pieces can be snipped off as needed. This prevents wasted time through long lineups at the dispenser. Hang your extra rolls on the blackboard on pieces of cord and tie a pair of scissors close by. This lets the children get any extra tape they need and eliminates the danger of carrying scissors in a crowded, busy room.

Bulk Supplies can be obtained from:

(1) Army and Navy Department Stores, Vancouver and New Westminster. Small hardware, tape, flying lines, etc.

(2) Nikka Overseas Agency Ltd., 378 E. Powell, Vancouver 4, 684-4155, large quantities of inexpensive flying line can be purchased here in bulk. Twine, cord and nylon monofilament fishing line is sold by the 1/4 pound, 1/2 pound and 1 pound spool.



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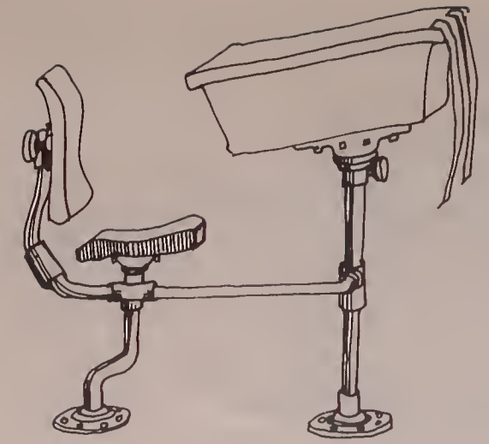

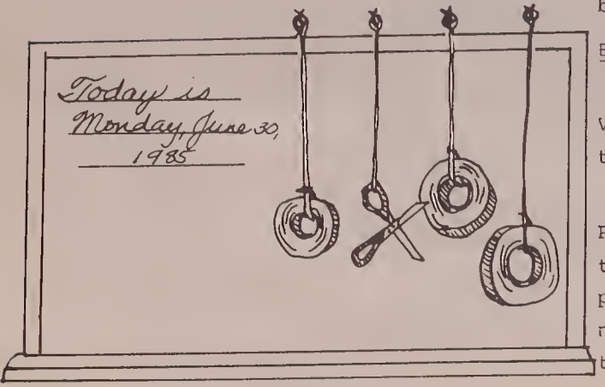


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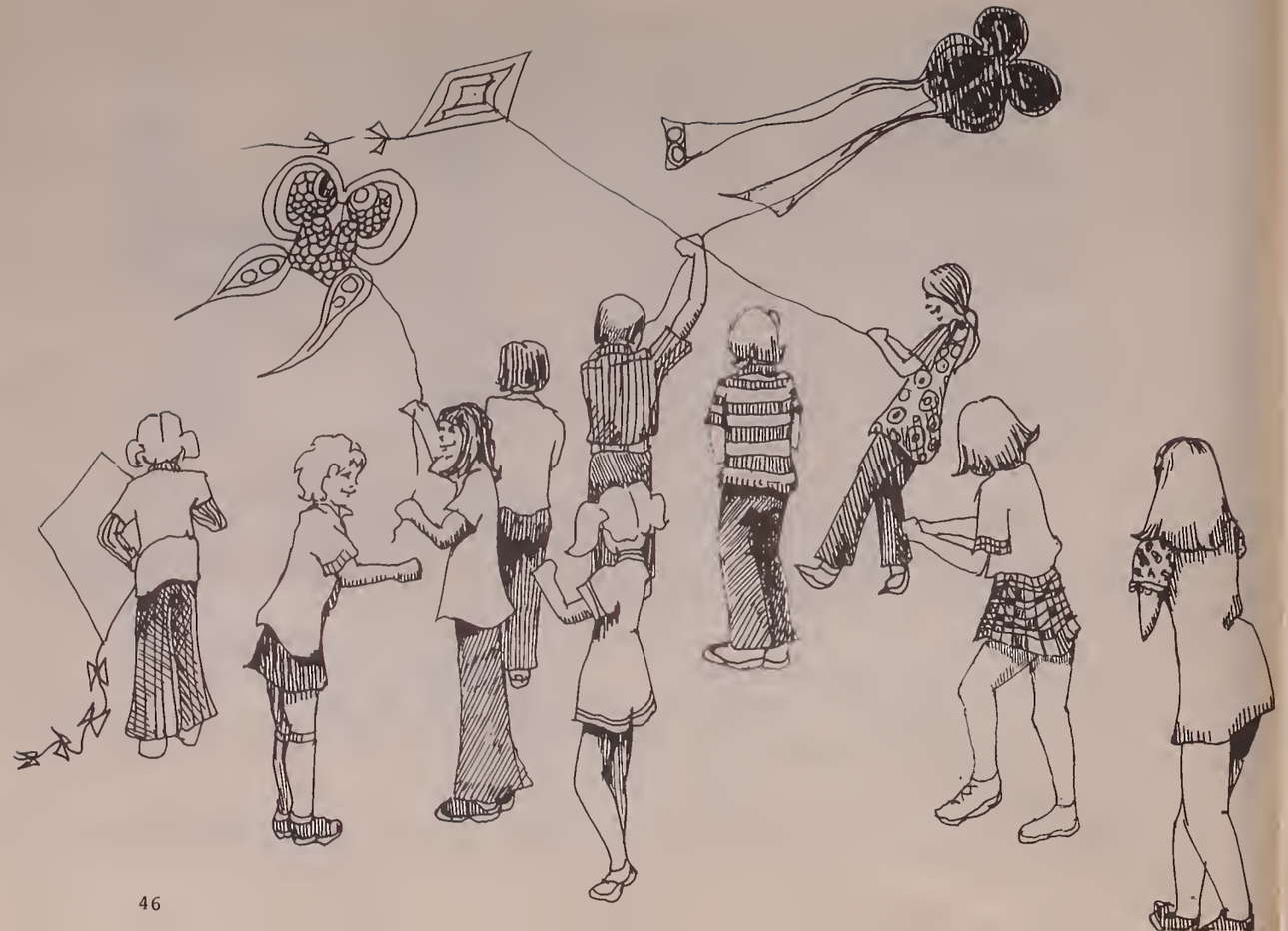



Glossary

Bridle - the arrangement of string or strings that are tied to the face of the kite. Determines flying angle, distributes stress and where the flying line is tied. A bridle can have several legs.

Cell - the open symmetrical shape on box, coyne, or tetrahedral kite that is formed either by struts or the force of the wind.

Dihedral - the angle formed by struts, joining faces. i.e. cells in the box kite 90°, Coyne kite 60°, Bow kite 160° to 165°.

Drag - a force that acts along the flying string. Also acts on the tail to balance the kite in flight.

Flying Line - the line or lines by which the kite is flown and manoeuvered.

Gravity - a force which acts downward.

Keel - the longitudinal structural member to which the bridle is usually attached. Sometimes called the longeron, mast, or center pole, depending on kite type.

Lift - a force acting to keep the kite up.

Pocket - the slack that develops on the face of a kite and helps it fly.

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Pocket - the slack that develops on the face of a kite and helps it fly.

Spar - the support(s) which usually support the face of the kite, a wing or wings. Also determines shape in many kites. Bow, Coyne, and so on.

Wind - which hits the kite and causes a horizontal force.



BIBLIOGRAPHY

* Brummitt, Wyatt. Kites. New York, Western Publishing Company, Inc., 1971. (A Golden Handbook Guide) $1.50.

* Hunt, Leslie L. Kite Making, Getting Started. London, Collin-Macmillan (Revision of 25 kites that fly) $2.95.

Hunt, Leslie L. 25 Kites That Fly. New York, Cover Publications, Inc., 1971. (First published by The Bruce Publishing Company in 1929.)

* Jue, David F. Chinese Kites: How to Make and Fly Them. Tokyo, Charles E. Tuttle, Co., 1967 ($3.75).

Peterson, John. High Flying Kites. Toronto, Scholastic Book Service ($.65).

* Wagenvoord, James. Flying Kites. Toronto, Collier-Macmillan Canada Ltd., 1968 ($2.95).

* All these books are excellent source books for the classroom.

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## KITE FLYING SAFETY CODE

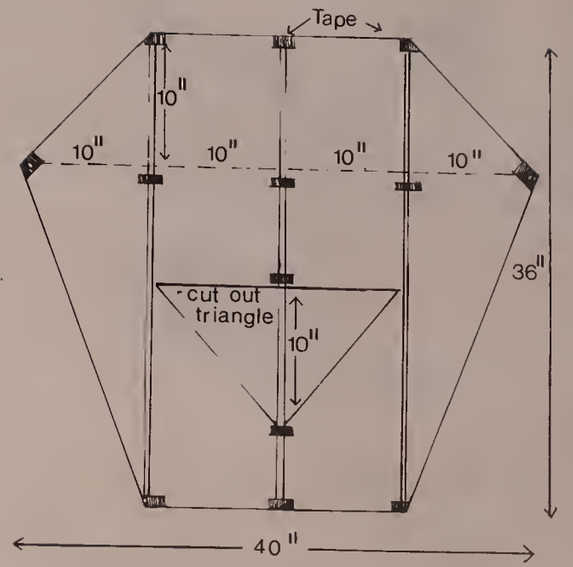
This is the safety code of the International Kiteflyers Association.

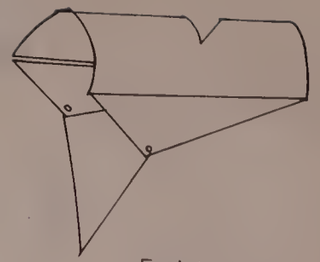
As a member of the International Kitefliers Association I will do my best to maintain the safety record of the organization and I will obey the safety code stated herein.

1. I will obey the laws regarding local kite flying.
2. I will not fly kites above the legal air limit set in my region.
3. I will not fly kites across automobile roads.
4. I will not fly kites in areas where there are power lines, nor will I try to recover kites that have become entangled in these lines.
5. I will not fly kites which contain explosives of any kind.
6. I will not fly kites on rainy days.
7. I will not fly kites on beaches where there are a number of people present who may be cut by the strings.
8. I will not fly razor blade studded kites.
9. I will use gloves in flying kites five feet large or over.
10. I will not fly kites in conditions of low visibility or in any area where they may endanger aircraft in flight.



## SCOTT SLED



Eyelet with plastic tape for reinforcement

Spars of 3/8" or 1/4" dowels from a hobby shop work well.

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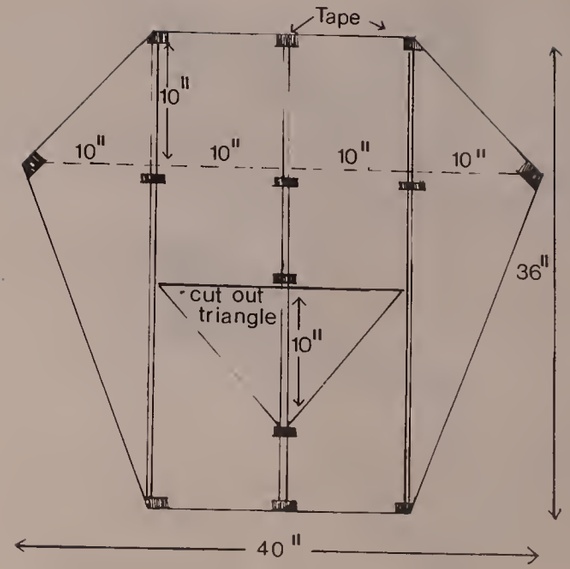


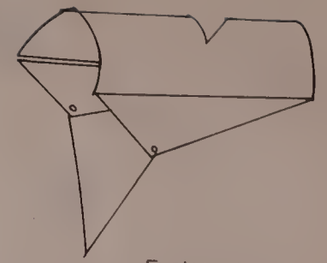

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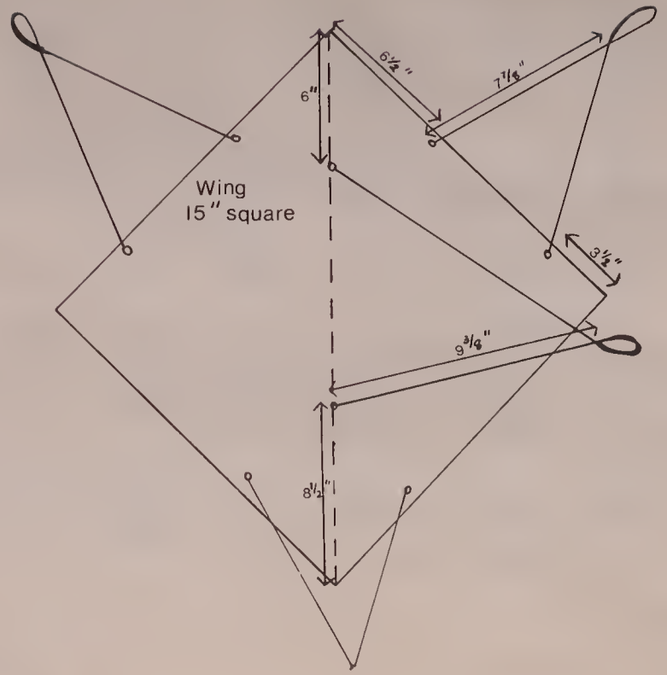
# ROGALLO PARAWING



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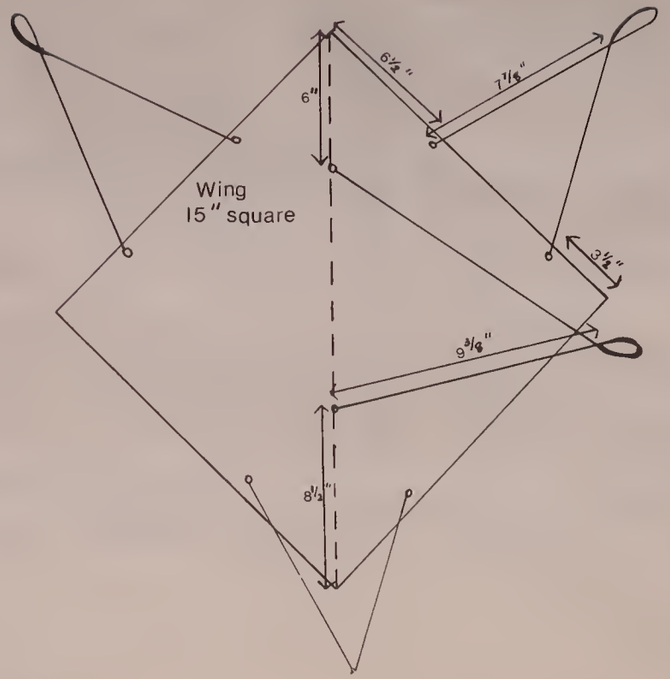

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